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Caddy

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[54] COMPUTER-AIDED PROCESS FOR GENERATING CAMERA-READY GRAPHICAL ARTWORK

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[73] Assignee: The United States of America as represented by the Secretary of the Navy, Washington, D.C.

[21] Appl. No.: 528,710

[22] Filed: Sep. 1, 1983

[51] Int. Cl.⁴ G06F 15/06; H04N 7/00
[52] U.S. Cl. 364/521; 364/300
[58] Field of Search 364/521, 519, 520, 300, 364/189, 518, 512; 340/728, 723

[56] References Cited

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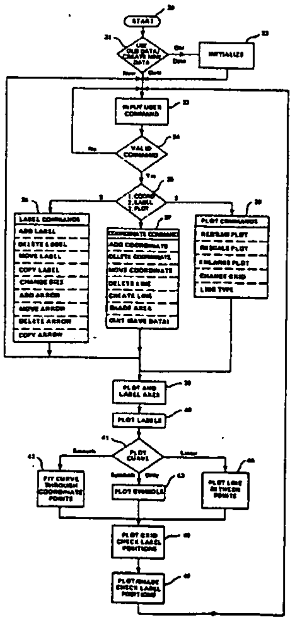
Attorney, Agent, or Firm—Robert F. Beers; Henry Hansen; Armand M. Vozzo, Jr.

[57] ABSTRACT

A computer-aided process is disclosed for automatically generating a camera-ready hardcopy of a graphical plot upon command instructions inputted via a conventional storage tube graphics display terminal having an addressable cross-hair cursor and a keyboard. In accordance with an interactive graphics code or program, tabular data coordinates stored in computer file form are retrieved and plotted on appropriately titled and scaled axes with the plotted coordinates being interconnected along curves formed of a smooth or linear nature by interpolation. The graphical plot viewed on the display terminal is further enhanced by inclusion of labels, shaded areas, and reference symbols and characters prior to printing out the hardcopy of an associated hardcopy unit coupled to the display terminal.

5 Claims, 18 Drawing Figures



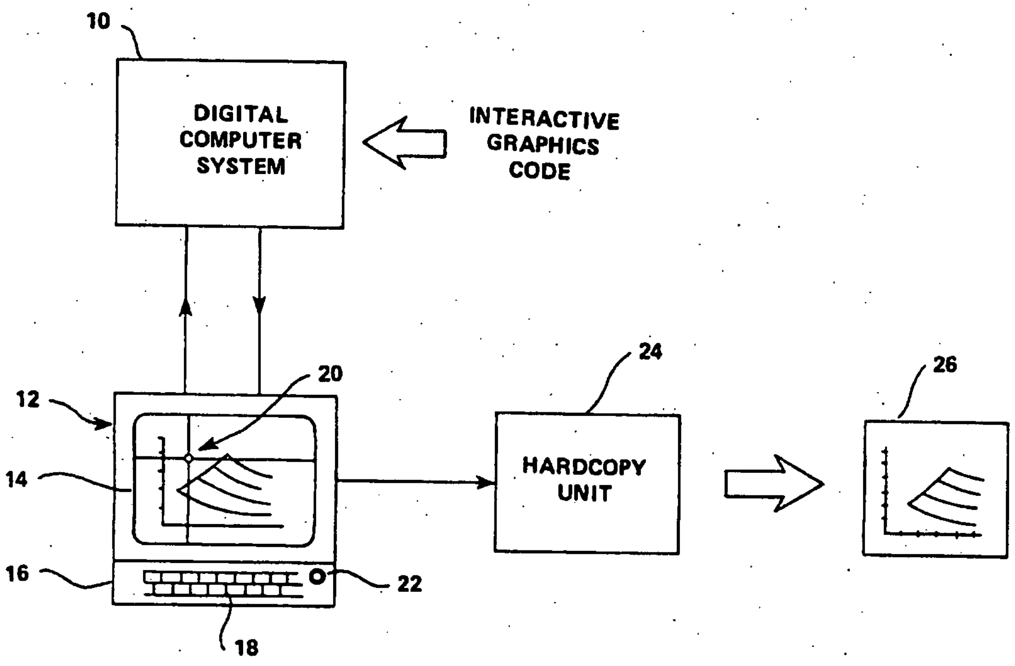

10
DIGITAL
COMPUTER
SYSTEM
INTERACTIVE
GRAPHICS
CODE
12
20
14
16
22
18
24
HARDCOPY
UNIT
26

FIG. 1

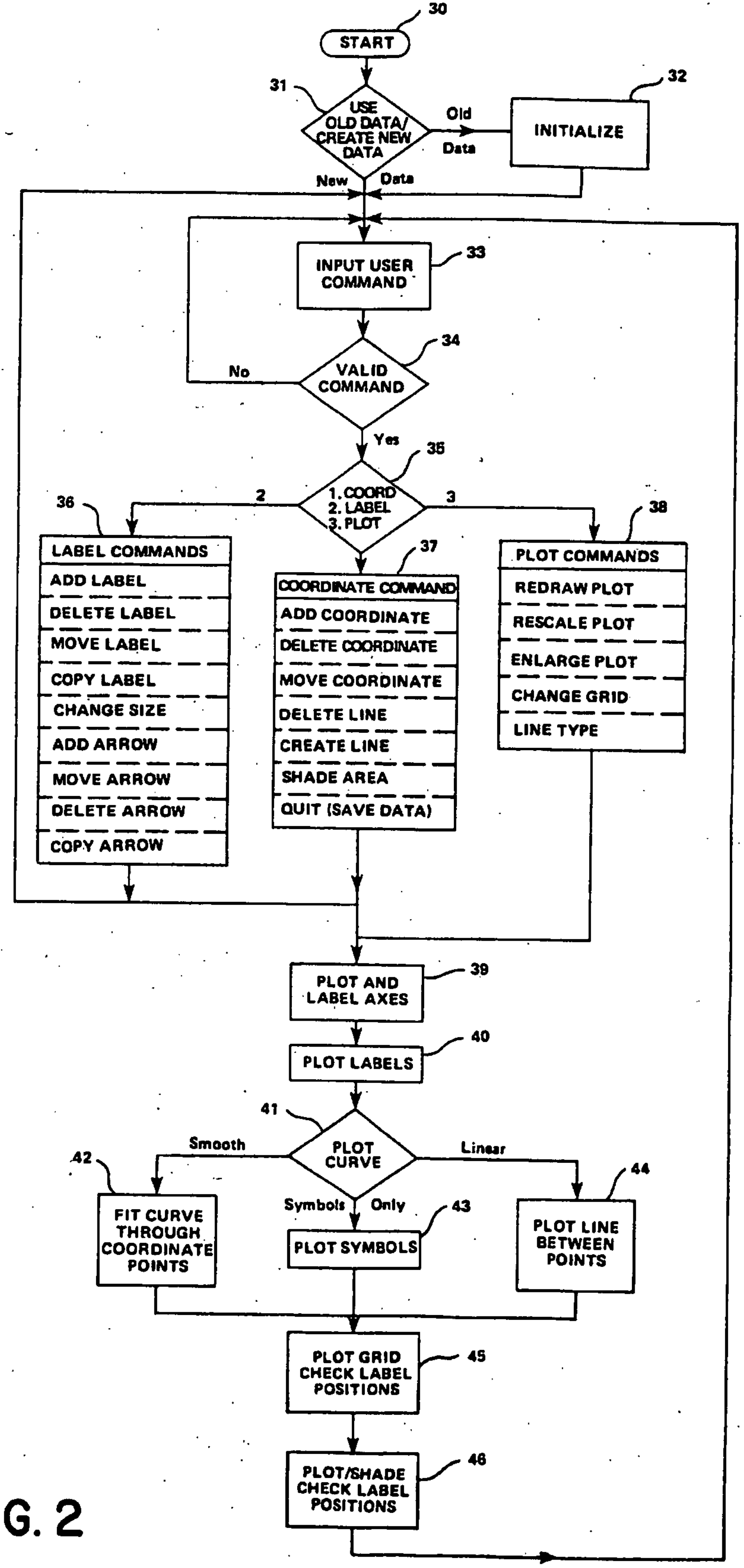

30
START
31
USE OLD DATA/ CREATE NEW DATA
Old Data
32
INITIALIZE
New Data
INPUT USER COMMAND
33
VALID COMMAND
34
No
Yes
35
1. COORD
2. LABEL
3. PLOT
2
3
36
LABEL COMMANDS
ADD LABEL
DELETE LABEL
MOVE LABEL
COPY LABEL
CHANGE SIZE
ADD ARROW
MOVE ARROW
DELETE ARROW
COPY ARROW
37
COORDINATE COMMAND
ADD COORDINATE
DELETE COORDINATE
MOVE COORDINATE
DELETE LINE
CREATE LINE
SHADE AREA
QUIT (SAVE DATA)
38
PLOT COMMANDS
REDRAW PLOT
RESCALE PLOT
ENLARGE PLOT
CHANGE GRID
LINE TYPE
PLOT AND LABEL AXES
39
PLOT LABELS
40
41
PLOT CURVE
Smooth
Linear
Symbols Only
42
FIT CURVE THROUGH COORDINATE POINTS
PLOT SYMBOLS
43
44
PLOT LINE BETWEEN POINTS
PLOT GRID CHECK LABEL POSITIONS
45
PLOT/SHADE CHECK LABEL POSITIONS
46

FIG. 2

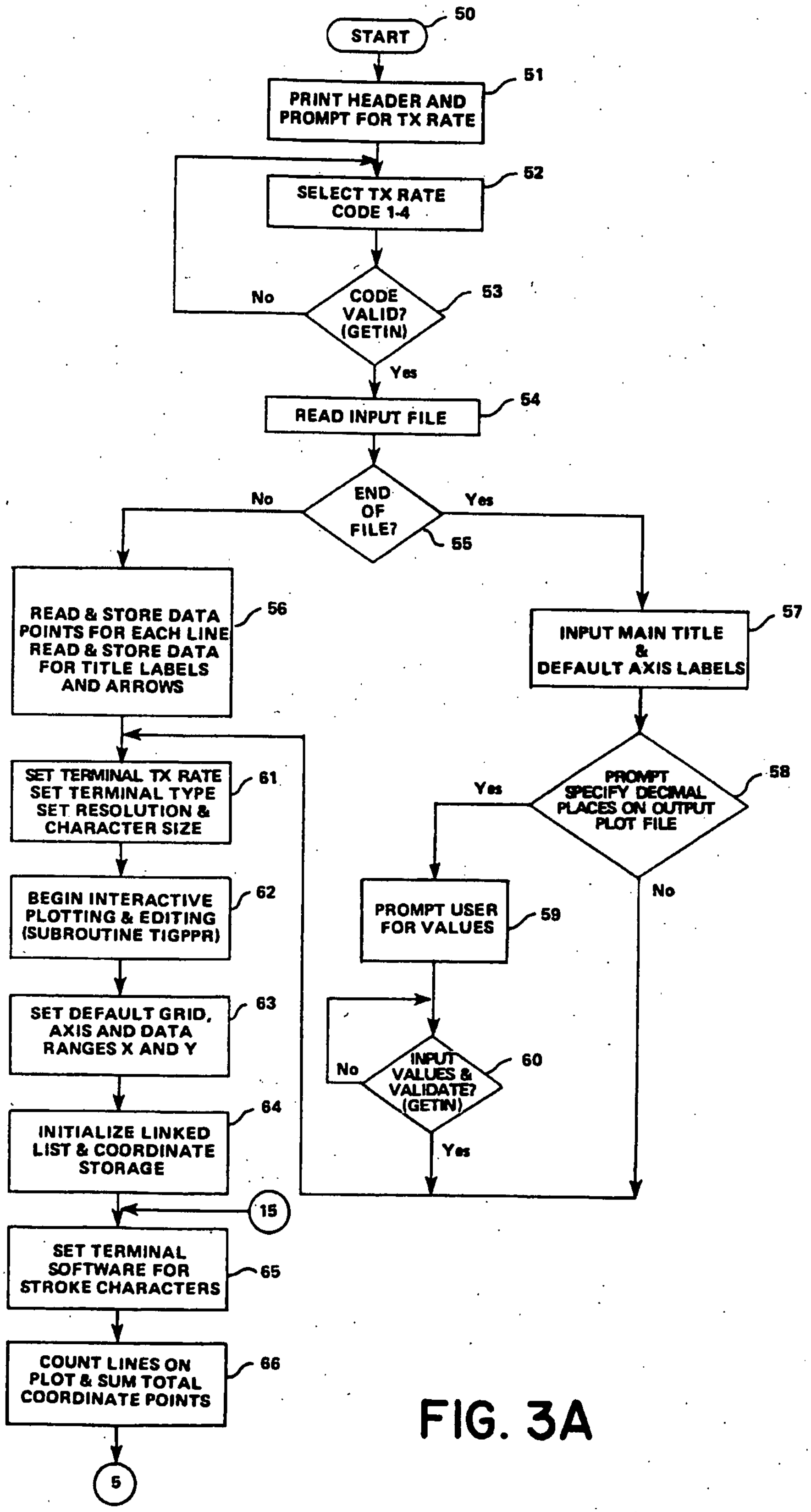

START
50
PRINT HEADER AND PROMPT FOR TX RATE
51
SELECT TX RATE CODE 1-4
52
CODE VALID? (GETIN)
53
No
Yes
READ INPUT FILE
54
END OF FILE?
55
No
Yes
READ & STORE DATA POINTS FOR EACH LINE READ & STORE DATA FOR TITLE LABELS AND ARROWS
56
INPUT MAIN TITLE & DEFAULT AXIS LABELS
57
PROMPT SPECIFY DECIMAL PLACES ON OUTPUT PLOT FILE
58
Yes
No
PROMPT USER FOR VALUES
59
INPUT VALUES & VALIDATE? (GETIN)
60
No
Yes
SET TERMINAL TX RATE SET TERMINAL TYPE SET RESOLUTION & CHARACTER SIZE
61
BEGIN INTERACTIVE PLOTTING & EDITING (SUBROUTINE TIGPPR)
62
SET DEFAULT GRID, AXIS AND DATA RANGES X AND Y
63
INITIALIZE LINKED LIST & COORDINATE STORAGE
64
15
SET TERMINAL SOFTWARE FOR STROKE CHARACTERS
65
COUNT LINES ON PLOT & SUM TOTAL COORDINATE POINTS
66
5

FIG. 3A

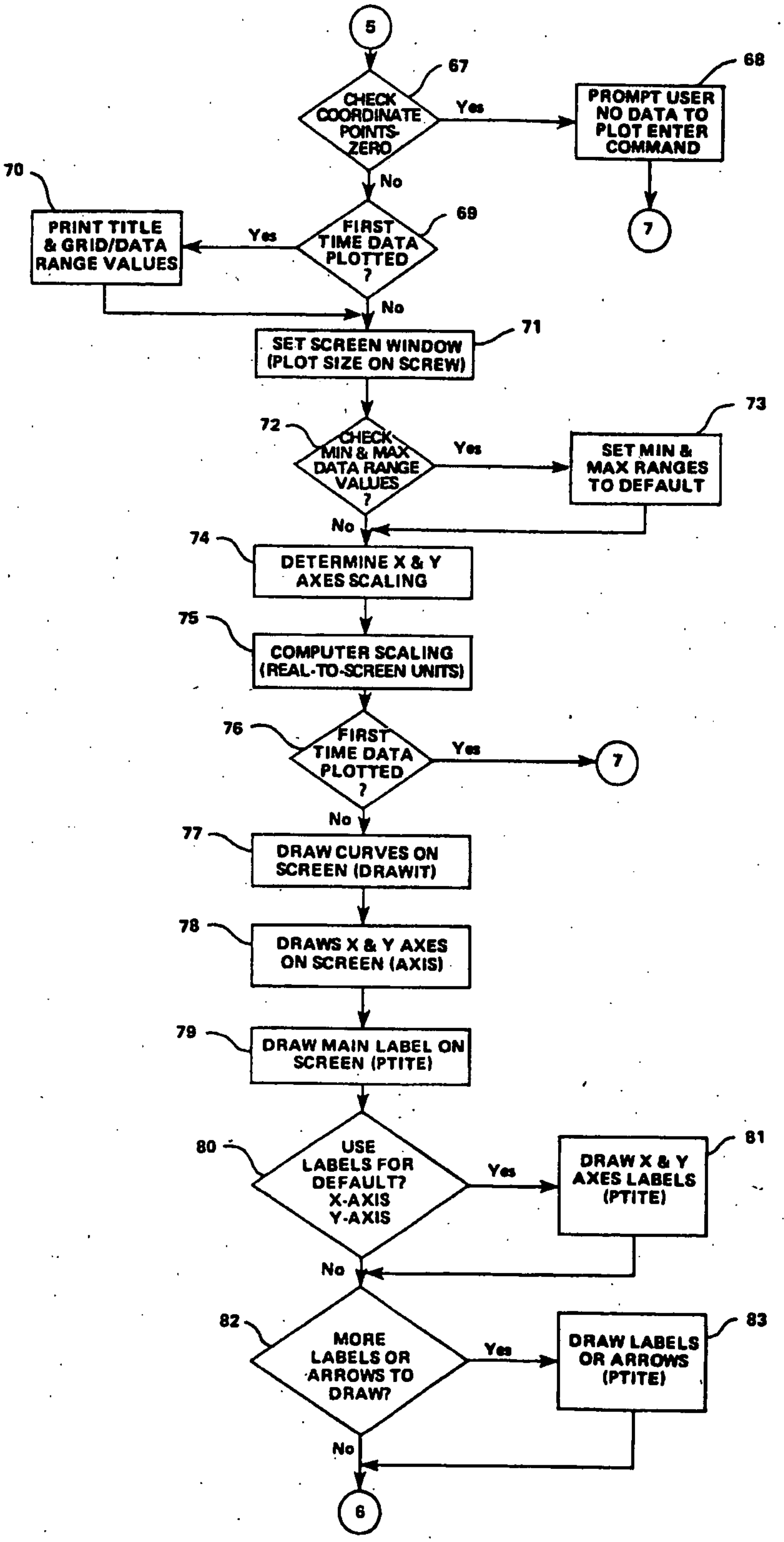

5
67
CHECK COORDINATE POINTS-ZERO
Yes
68
PROMPT USER NO DATA TO PLOT ENTER COMMAND
7
No
70
PRINT TITLE & GRID/DATA RANGE VALUES
Yes
FIRST TIME DATA PLOTTED ?
69
No
SET SCREEN WINDOW (PLOT SIZE ON SCREW)
71
72
CHECK MIN & MAX DATA RANGE VALUES ?
Yes
73
SET MIN & MAX RANGES TO DEFAULT
No
74
DETERMINE X & Y AXES SCALING
75
COMPUTER SCALING (REAL-TO-SCREEN UNITS)
76
FIRST TIME DATA PLOTTED ?
Yes
7
No
77
DRAW CURVES ON SCREEN (DRAWIT)
78
DRAWS X & Y AXES ON SCREEN (AXIS)
79
DRAW MAIN LABEL ON SCREEN (PTITE)
80
USE LABELS FOR DEFAULT? X-AXIS Y-AXIS
Yes
81
DRAW X & Y AXES LABELS (PTITE)
No
82
MORE LABELS OR ARROWS TO DRAW?
Yes
83
DRAW LABELS OR ARROWS (PTITE)
No
6

FIG. 3B

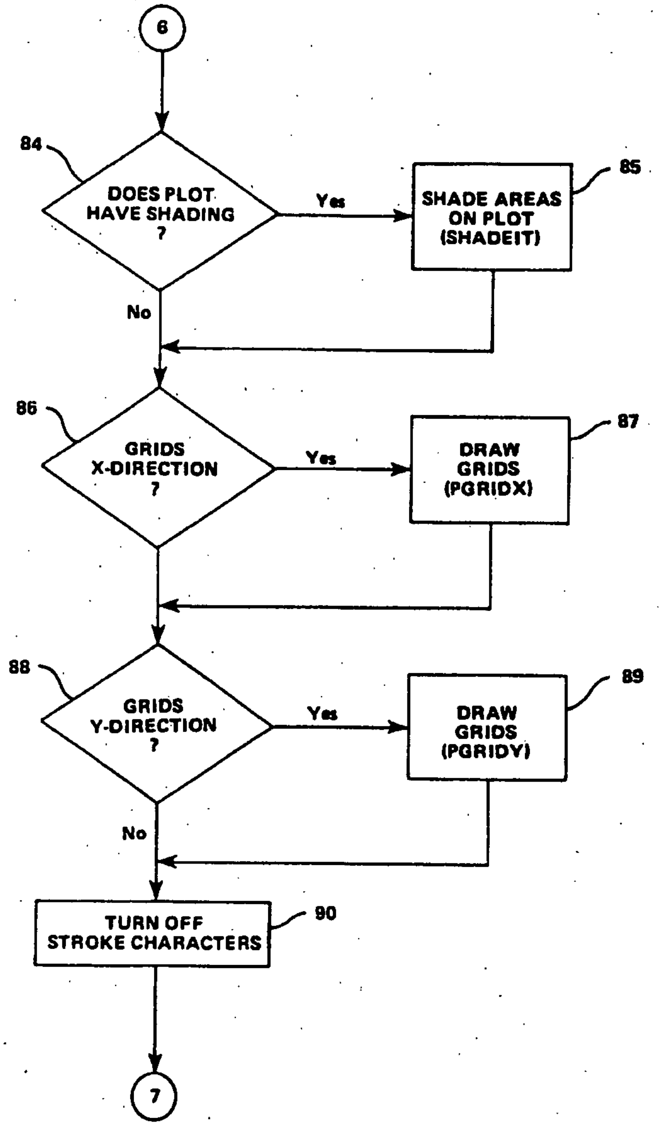

6
84
DOES PLOT HAVE SHADING ?
Yes
SHADE AREAS ON PLOT (SHADEIT)
85
No
86
GRIDS X-DIRECTION ?
Yes
DRAW GRIDS (PGRIDX)
87
88
GRIDS Y-DIRECTION ?
Yes
DRAW GRIDS (PGRIDY)
89
No
TURN OFF STROKE CHARACTERS
90
7

FIG. 3C

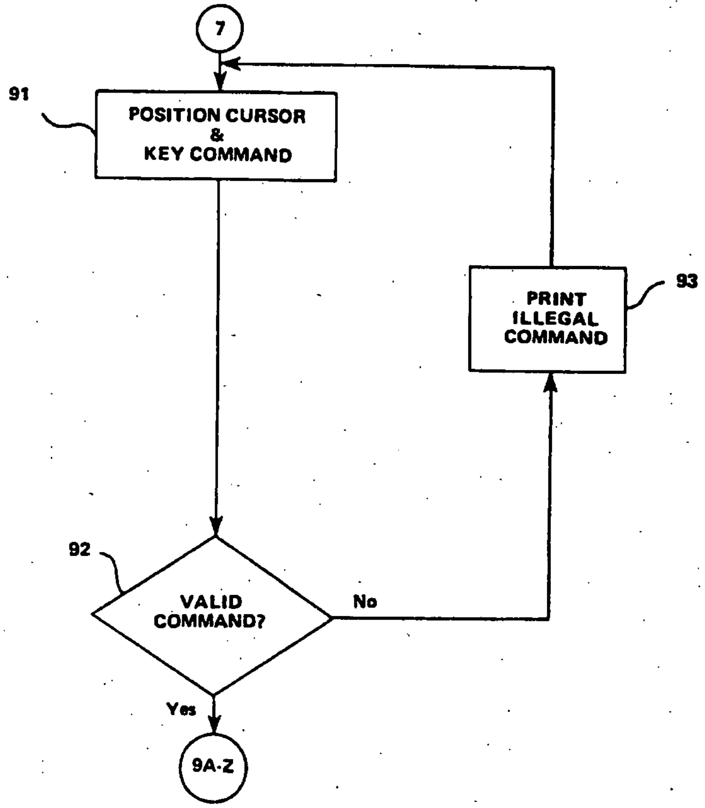

7
91
POSITION CURSOR & KEY COMMAND
PRINT ILLEGAL COMMAND
93
92
VALID COMMAND?
No
Yes
9A-Z

FIG. 3D

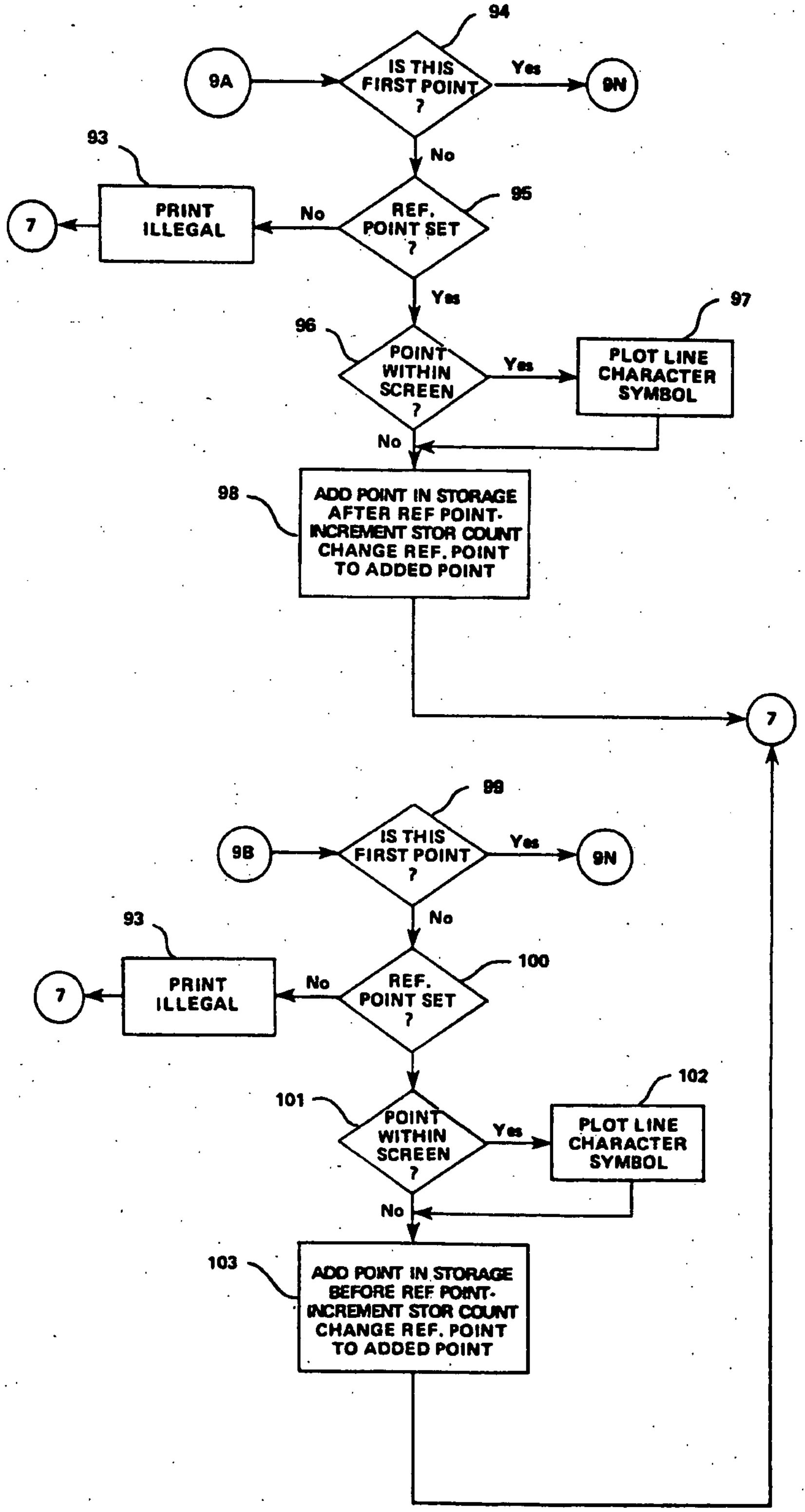

94
9A
IS THIS FIRST POINT ?
Yes
9N
No
93
PRINT ILLEGAL
No
REF. POINT SET ?
95
7
Yes
97
96
POINT WITHIN SCREEN ?
Yes
PLOT LINE CHARACTER SYMBOL
No
98
ADD POINT IN STORAGE AFTER REF POINT· INCREMENT STOR COUNT CHANGE REF. POINT TO ADDED POINT
7
99
9B
IS THIS FIRST POINT ?
Yes
9N
No
93
PRINT ILLEGAL
No
REF. POINT SET ?
100
7
102
101
POINT WITHIN SCREEN ?
Yes
PLOT LINE CHARACTER SYMBOL
No
103
ADD POINT IN STORAGE BEFORE REF POINT· INCREMENT STOR COUNT CHANGE REF. POINT TO ADDED POINT

FIG. 3E

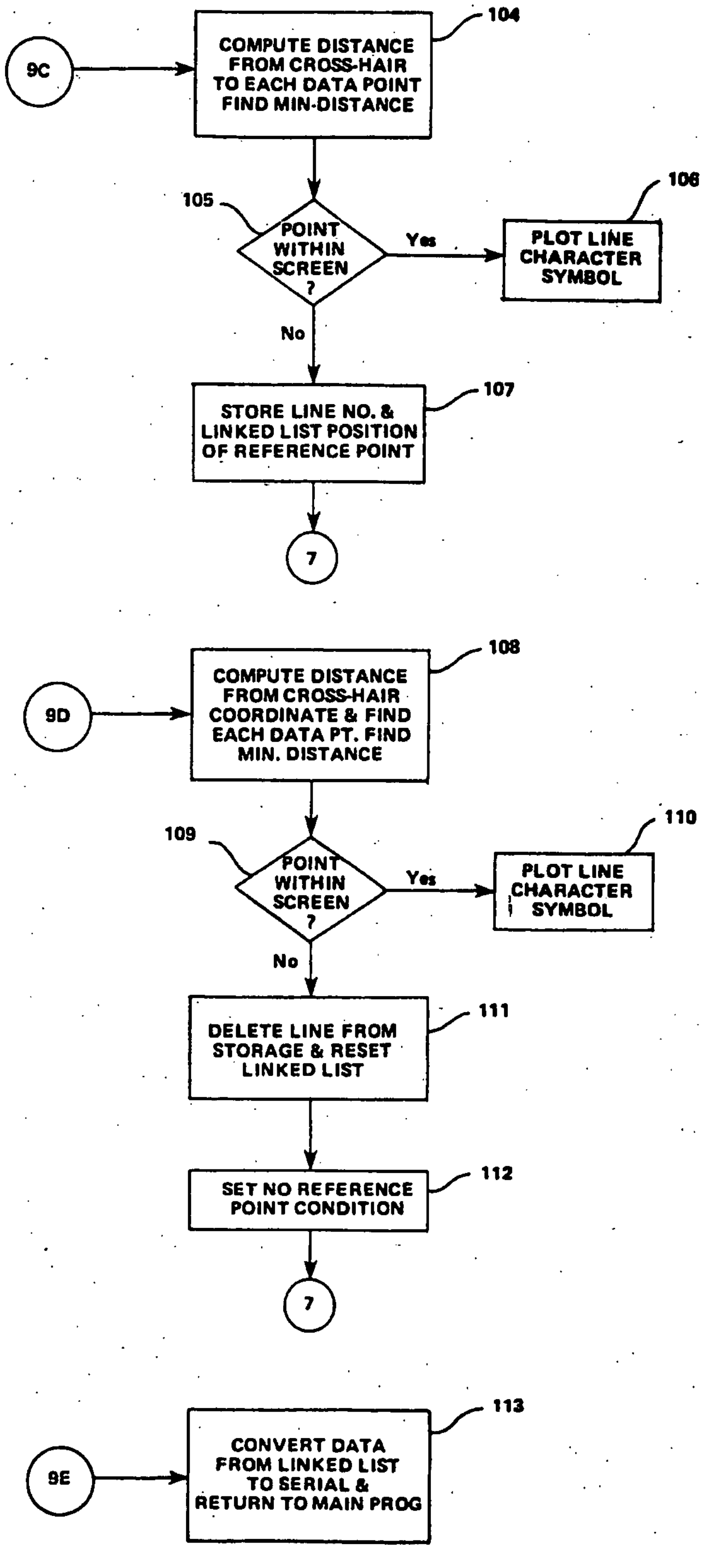

9C
COMPUTE DISTANCE FROM CROSS-HAIR TO EACH DATA POINT FIND MIN-DISTANCE
104
105
POINT WITHIN SCREEN ?
Yes
PLOT LINE CHARACTER SYMBOL
106
No
STORE LINE NO. & LINKED LIST POSITION OF REFERENCE POINT
107
7
9D
COMPUTE DISTANCE FROM CROSS-HAIR COORDINATE & FIND EACH DATA PT. FIND MIN. DISTANCE
108
109
POINT WITHIN SCREEN ?
Yes
PLOT LINE CHARACTER SYMBOL
110
No
DELETE LINE FROM STORAGE & RESET LINKED LIST
111
SET NO REFERENCE POINT CONDITION
112
7
9E
CONVERT DATA FROM LINKED LIST TO SERIAL & RETURN TO MAIN PROG
113

FIG. 3F

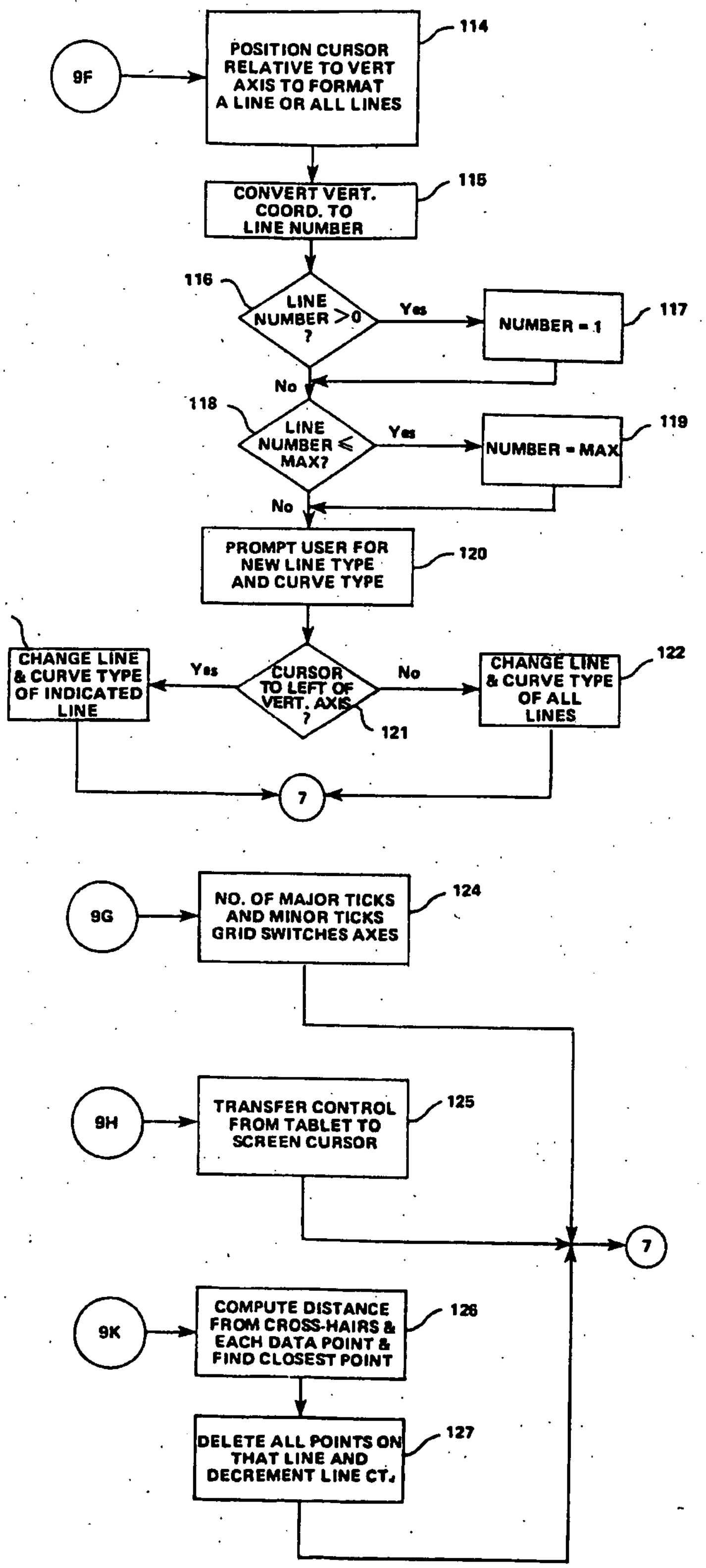

9F
POSITION CURSOR RELATIVE TO VERT AXIS TO FORMAT A LINE OR ALL LINES
114
CONVERT VERT. COORD. TO LINE NUMBER
115
116
LINE NUMBER >0 ?
Yes
NUMBER = 1
117
No
118
LINE NUMBER ≤ MAX?
Yes
NUMBER = MAX
119
No
PROMPT USER FOR NEW LINE TYPE AND CURVE TYPE
120
123
CHANGE LINE & CURVE TYPE OF INDICATED LINE
Yes
CURSOR TO LEFT OF VERT. AXIS ?
121
No
CHANGE LINE & CURVE TYPE OF ALL LINES
122
7
9G
NO. OF MAJOR TICKS AND MINOR TICKS GRID SWITCHES AXES
124
9H
TRANSFER CONTROL FROM TABLET TO SCREEN CURSOR
125
7
9K
COMPUTE DISTANCE FROM CROSS-HAIRS & EACH DATA POINT & FIND CLOSEST POINT
126
DELETE ALL POINTS ON THAT LINE AND DECREMENT LINE CT.
127

FIG. 3G

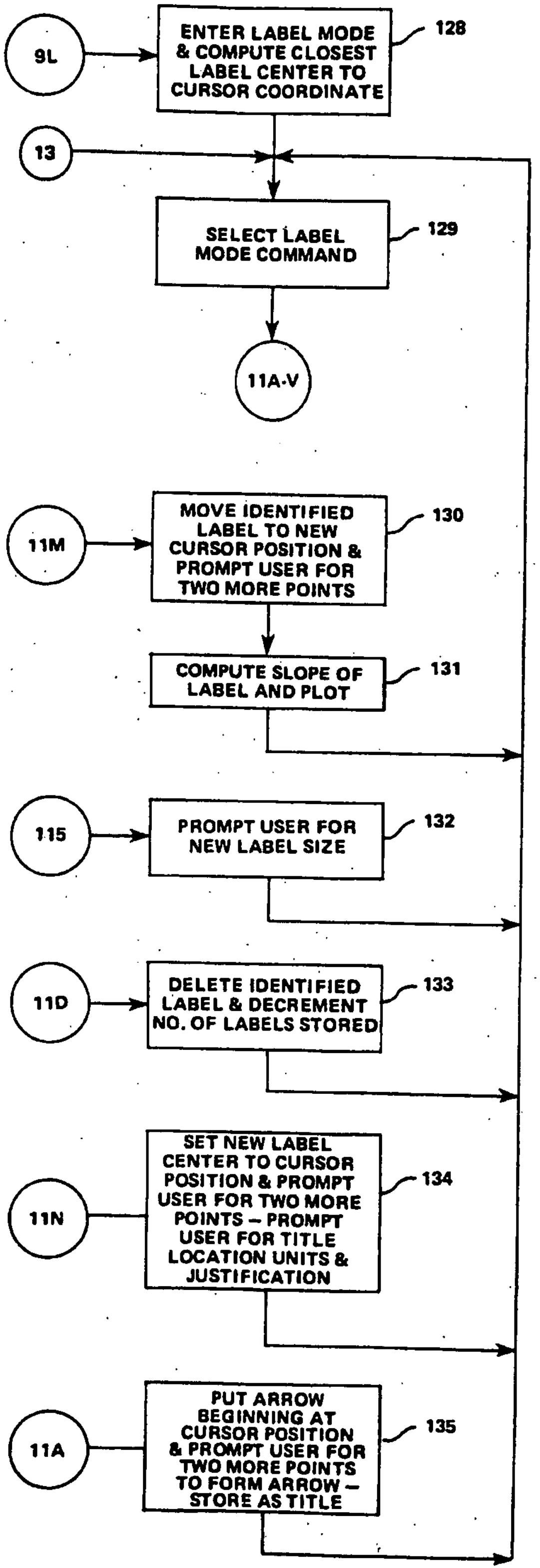

9L
ENTER LABEL MODE & COMPUTE CLOSEST LABEL CENTER TO CURSOR COORDINATE
128
13
SELECT LABEL MODE COMMAND
129
11A-V
11M
MOVE IDENTIFIED LABEL TO NEW CURSOR POSITION & PROMPT USER FOR TWO MORE POINTS
130
COMPUTE SLOPE OF LABEL AND PLOT
131
11S
PROMPT USER FOR NEW LABEL SIZE
132
11D
DELETE IDENTIFIED LABEL & DECREMENT NO. OF LABELS STORED
133
11N
SET NEW LABEL CENTER TO CURSOR POSITION & PROMPT USER FOR TWO MORE POINTS – PROMPT USER FOR TITLE LOCATION UNITS & JUSTIFICATION
134
11A
PUT ARROW BEGINNING AT CURSOR POSITION & PROMPT USER FOR TWO MORE POINTS TO FORM ARROW – STORE AS TITLE
135

FIG. 3H

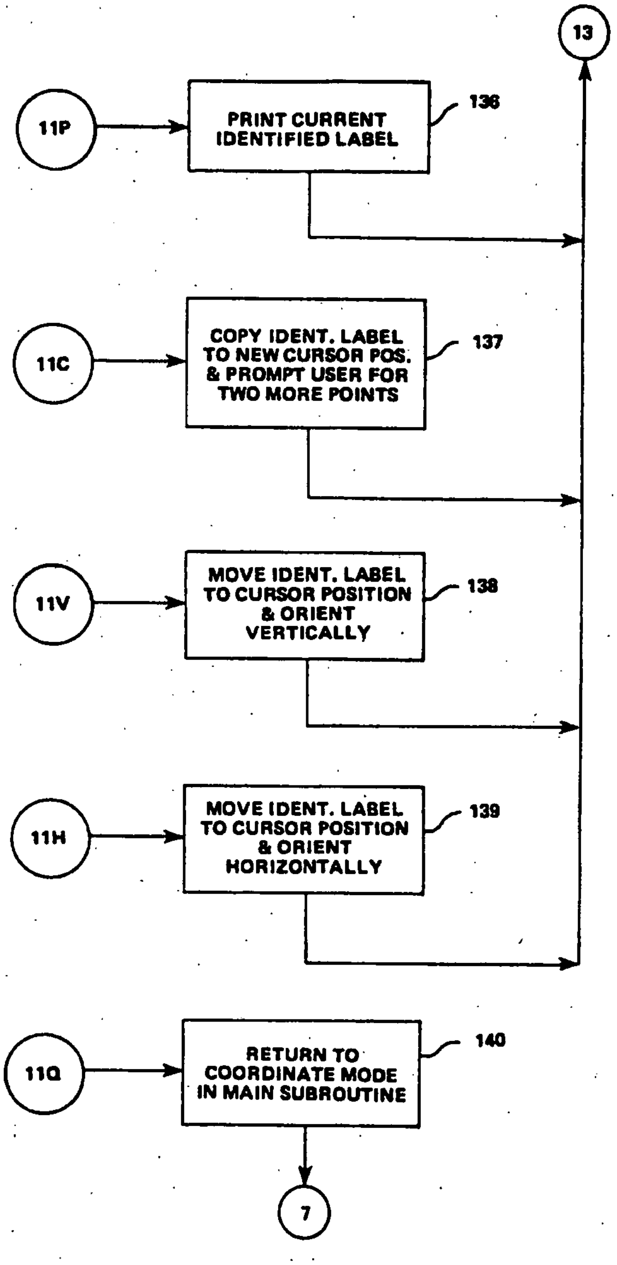

13
11P
PRINT CURRENT IDENTIFIED LABEL
136
11C
COPY IDENT. LABEL TO NEW CURSOR POS. & PROMPT USER FOR TWO MORE POINTS
137
11V
MOVE IDENT. LABEL TO CURSOR POSITION & ORIENT VERTICALLY
138
11H
MOVE IDENT. LABEL TO CURSOR POSITION & ORIENT HORIZONTALLY
139
11Q
RETURN TO COORDINATE MODE IN MAIN SUBROUTINE
140
7

FIG. 3I

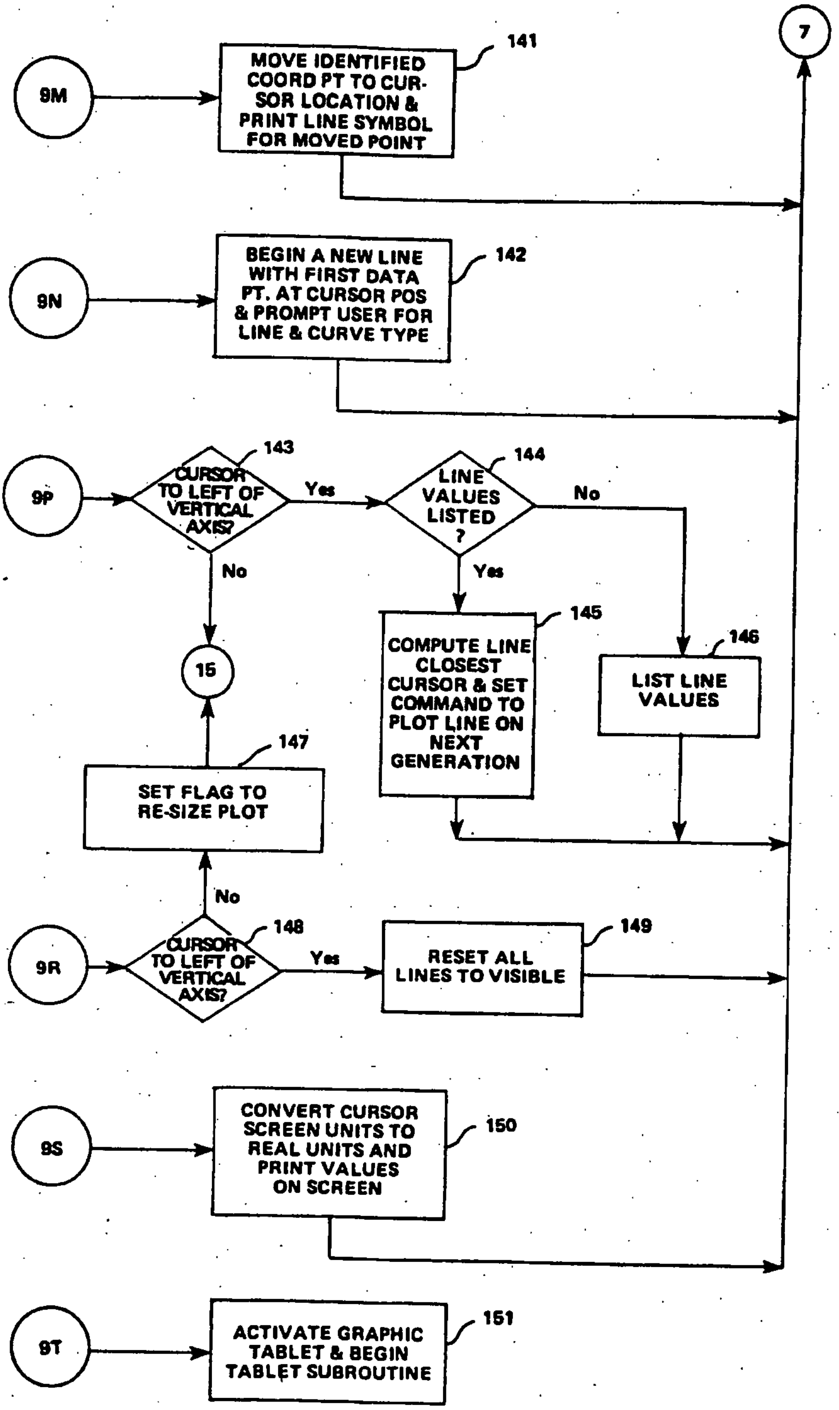

7
9M
MOVE IDENTIFIED COORD PT TO CURSOR LOCATION & PRINT LINE SYMBOL FOR MOVED POINT
141
9N
BEGIN A NEW LINE WITH FIRST DATA PT. AT CURSOR POS & PROMPT USER FOR LINE & CURVE TYPE
142
9P
CURSOR TO LEFT OF VERTICAL AXIS?
143
Yes
LINE VALUES LISTED ?
144
No
No
Yes
COMPUTE LINE CLOSEST CURSOR & SET COMMAND TO PLOT LINE ON NEXT GENERATION
145
LIST LINE VALUES
146
15
SET FLAG TO RE-SIZE PLOT
147
No
9R
CURSOR TO LEFT OF VERTICAL AXIS?
148
Yes
RESET ALL LINES TO VISIBLE
149
9S
CONVERT CURSOR SCREEN UNITS TO REAL UNITS AND PRINT VALUES ON SCREEN
150
9T
ACTIVATE GRAPHIC TABLET & BEGIN TABLET SUBROUTINE
151

FIG. 3J

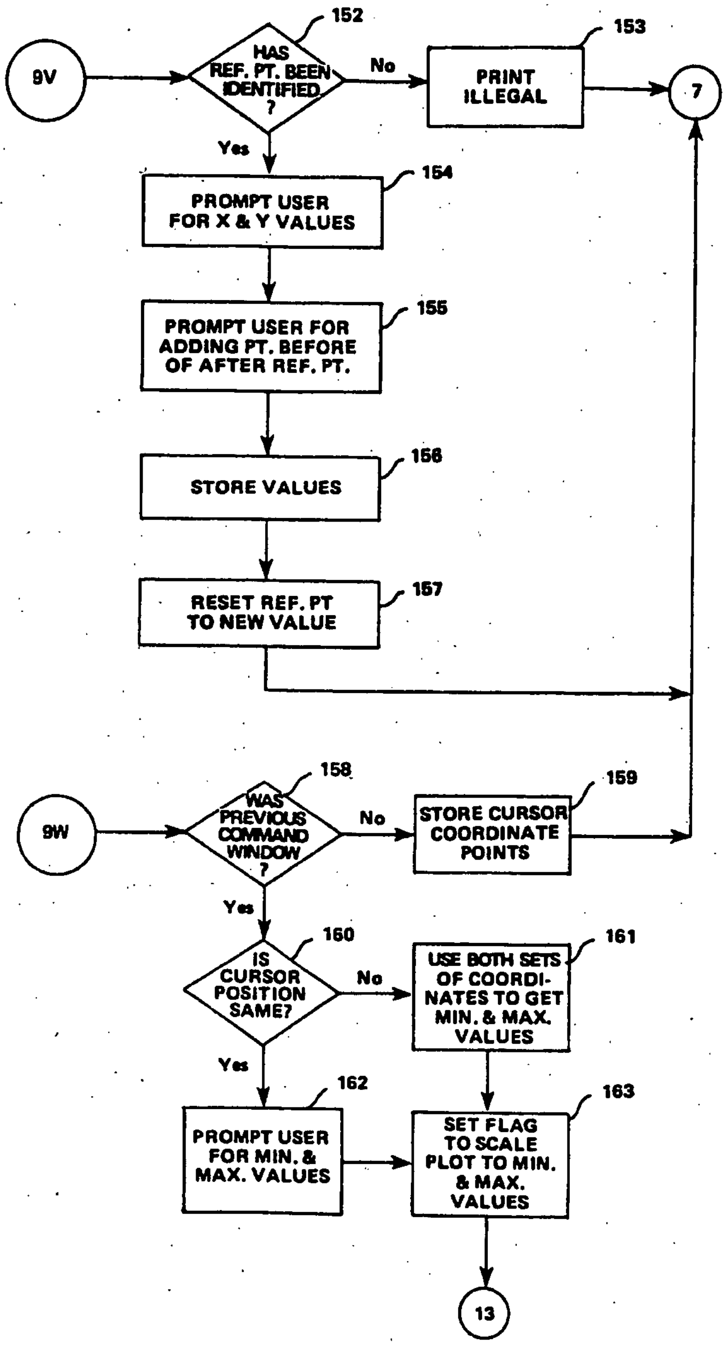

9V
HAS REF. PT. BEEN IDENTIFIED ?
152
No
Yes
PRINT ILLEGAL
153
7
PROMPT USER FOR X & Y VALUES
154
PROMPT USER FOR ADDING PT. BEFORE OF AFTER REF. PT.
155
STORE VALUES
156
RESET REF. PT TO NEW VALUE
157
9W
WAS PREVIOUS COMMAND WINDOW ?
158
No
Yes
STORE CURSOR COORDINATE POINTS
159
IS CURSOR POSITION SAME?
160
No
Yes
USE BOTH SETS OF COORDINATES TO GET MIN. & MAX. VALUES
161
PROMPT USER FOR MIN. & MAX. VALUES
162
SET FLAG TO SCALE PLOT TO MIN. & MAX. VALUES
163
13

FIG. 3K

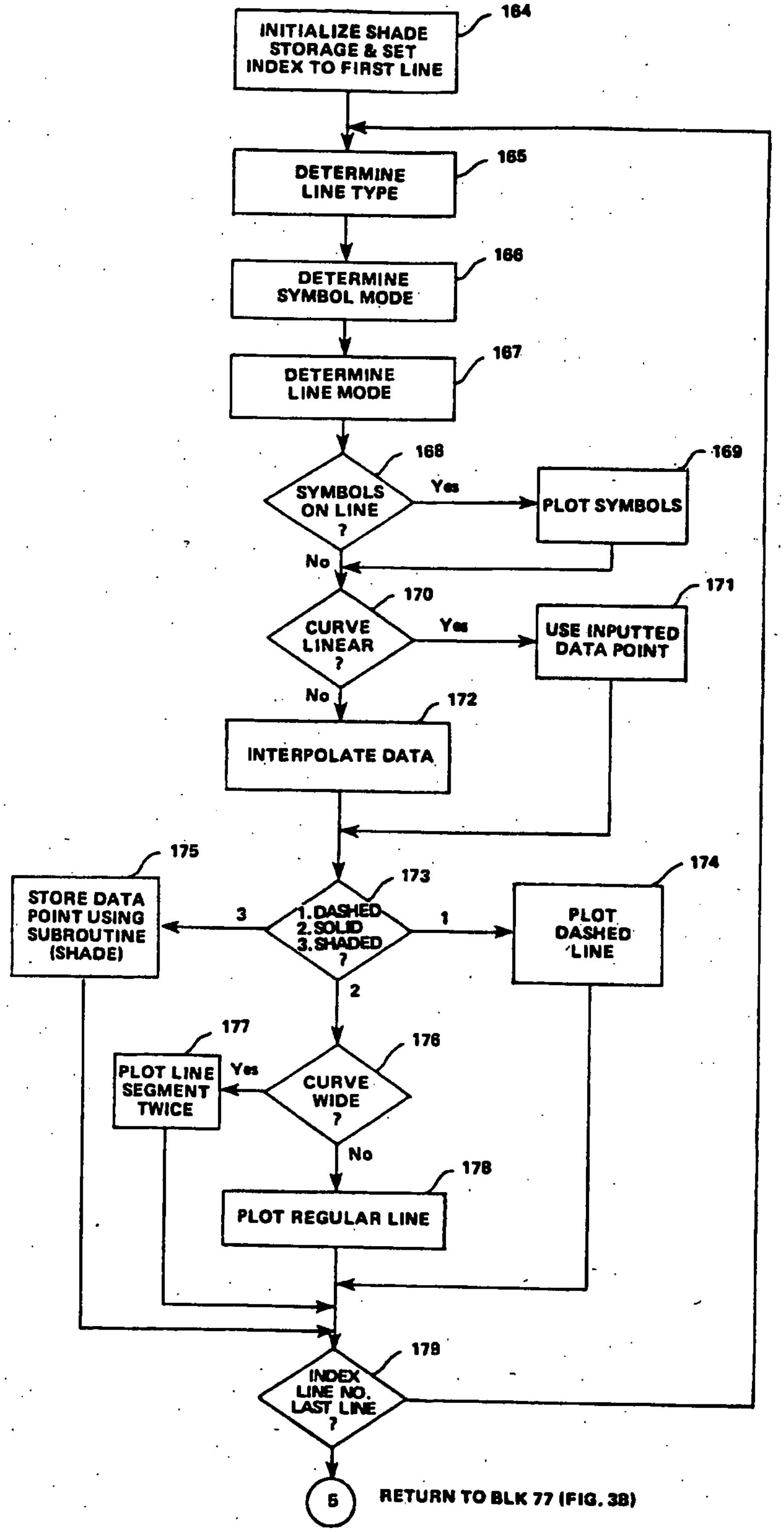

INITIALIZE SHADE STORAGE & SET INDEX TO FIRST LINE
164
DETERMINE LINE TYPE
165
DETERMINE SYMBOL MODE
166
DETERMINE LINE MODE
167
SYMBOLS ON LINE ?
168
Yes
PLOT SYMBOLS
169
No
CURVE LINEAR ?
170
Yes
USE INPUTTED DATA POINT
171
No
INTERPOLATE DATA
172
STORE DATA POINT USING SUBROUTINE (SHADE)
175
3
1. DASHED 2. SOLID 3. SHADED ?
173
1
PLOT DASHED LINE
174
2
PLOT LINE SEGMENT TWICE
177
Yes
CURVE WIDE ?
176
No
PLOT REGULAR LINE
178
INDEX LINE NO. LAST LINE ?
179
6
RETURN TO BLK 77 (FIG. 3B)

FIG. 3L

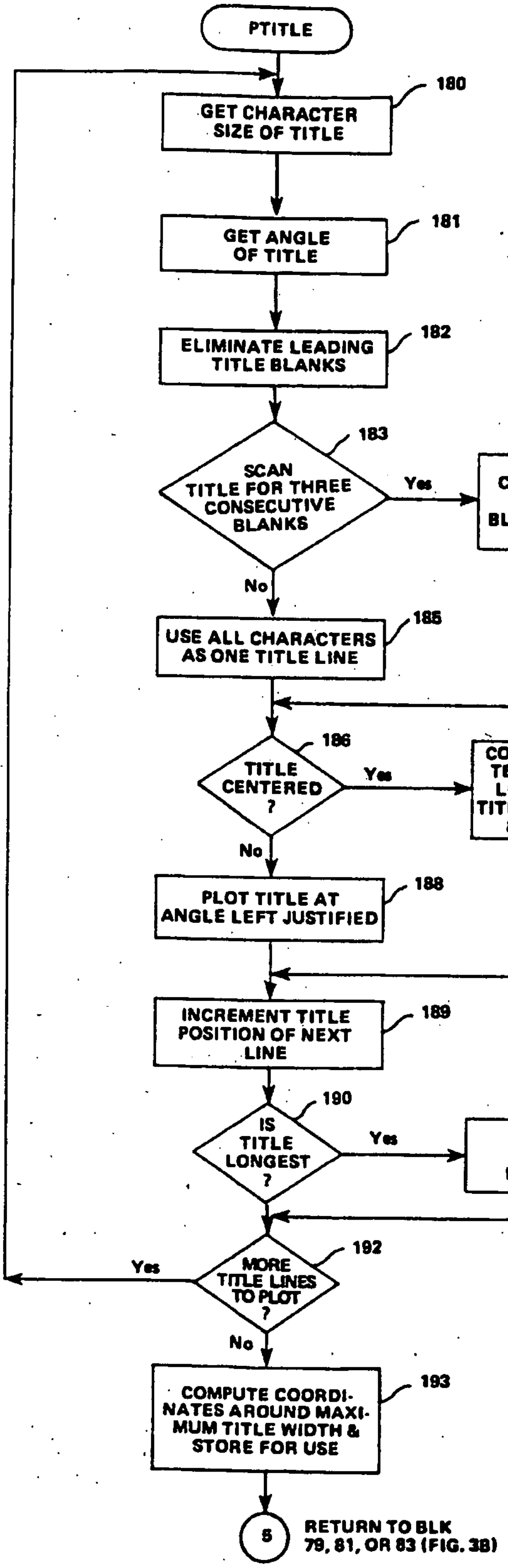

PTITLE
GET CHARACTER SIZE OF TITLE
180
GET ANGLE OF TITLE
181
ELIMINATE LEADING TITLE BLANKS
182
SCAN TITLE FOR THREE CONSECUTIVE BLANKS
183
Yes
USE CHARACTERS PRECEDING BLANKS AS ONE TITLE LINE
184
No
USE ALL CHARACTERS AS ONE TITLE LINE
185
TITLE CENTERED ?
186
Yes
COMPUTE CENTER OF TITLE LINE & PLOT TITLE AT ANGLE & CENTER
187
No
PLOT TITLE AT ANGLE LEFT JUSTIFIED
188
INCREMENT TITLE POSITION OF NEXT LINE
189
IS TITLE LONGEST ?
190
Yes
STORE TITLE LENGTH
191
MORE TITLE LINES TO PLOT ?
192
Yes
No
COMPUTE COORDINATES AROUND MAXIMUM TITLE WIDTH & STORE FOR USE
193
5
RETURN TO BLK 79, 81, OR 83 (FIG. 3B)

FIG. 3M

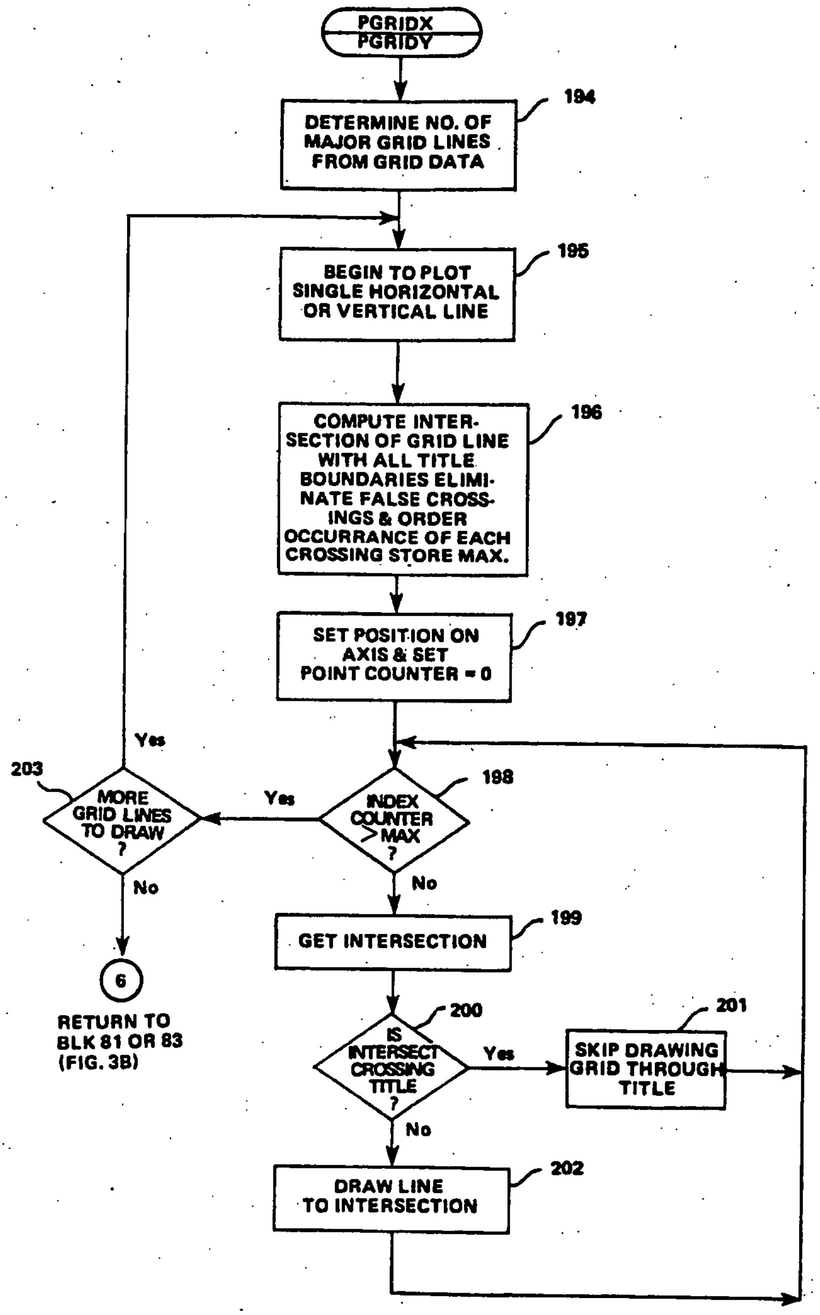

PGRIDX
PGRIDY
DETERMINE NO. OF MAJOR GRID LINES FROM GRID DATA
194
BEGIN TO PLOT SINGLE HORIZONTAL OR VERTICAL LINE
195
COMPUTE INTER-SECTION OF GRID LINE WITH ALL TITLE BOUNDARIES ELIMI-NATE FALSE CROSS-INGS & ORDER OCCURRANCE OF EACH CROSSING STORE MAX.
196
SET POSITION ON AXIS & SET POINT COUNTER = 0
197
Yes
203
MORE GRID LINES TO DRAW ?
Yes
INDEX COUNTER >MAX ?
198
No
No
GET INTERSECTION
199
6
RETURN TO BLK 81 OR 83 (FIG. 3B)
200
IS INTERSECT CROSSING TITLE ?
Yes
SKIP DRAWING GRID THROUGH TITLE
201
No
DRAW LINE TO INTERSECTION
202

FIG. 3N

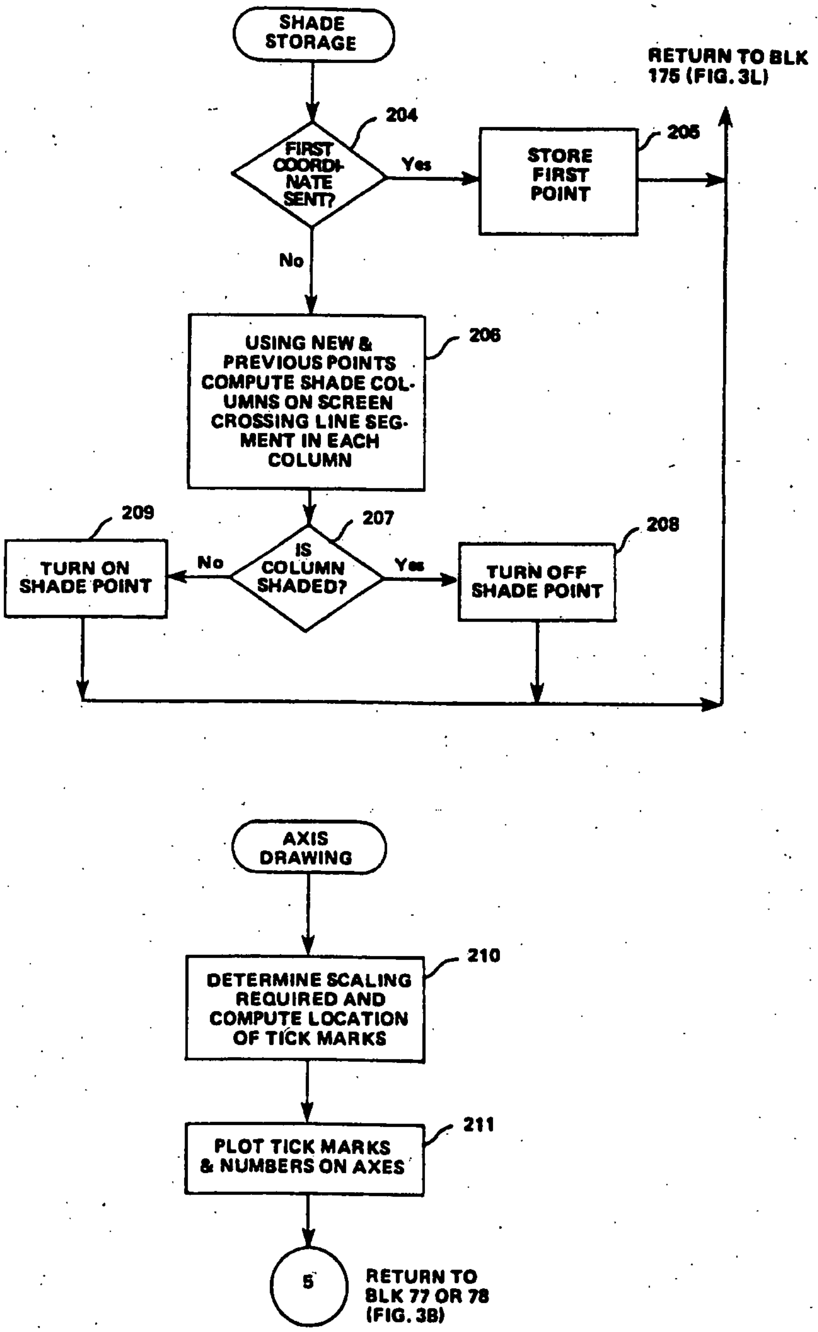

SHADE STORAGE
204
FIRST COORDINATE SENT?
Yes
No
STORE FIRST POINT
205
RETURN TO BLK 175 (FIG. 3L)
USING NEW & PREVIOUS POINTS COMPUTE SHADE COLUMNS ON SCREEN CROSSING LINE SEGMENT IN EACH COLUMN
206
209
TURN ON SHADE POINT
No
IS COLUMN SHADED?
207
Yes
TURN OFF SHADE POINT
208
AXIS DRAWING
DETERMINE SCALING REQUIRED AND COMPUTE LOCATION OF TICK MARKS
210
PLOT TICK MARKS & NUMBERS ON AXES
211
5
RETURN TO BLK 77 OR 78 (FIG. 3B)

FIG. 30

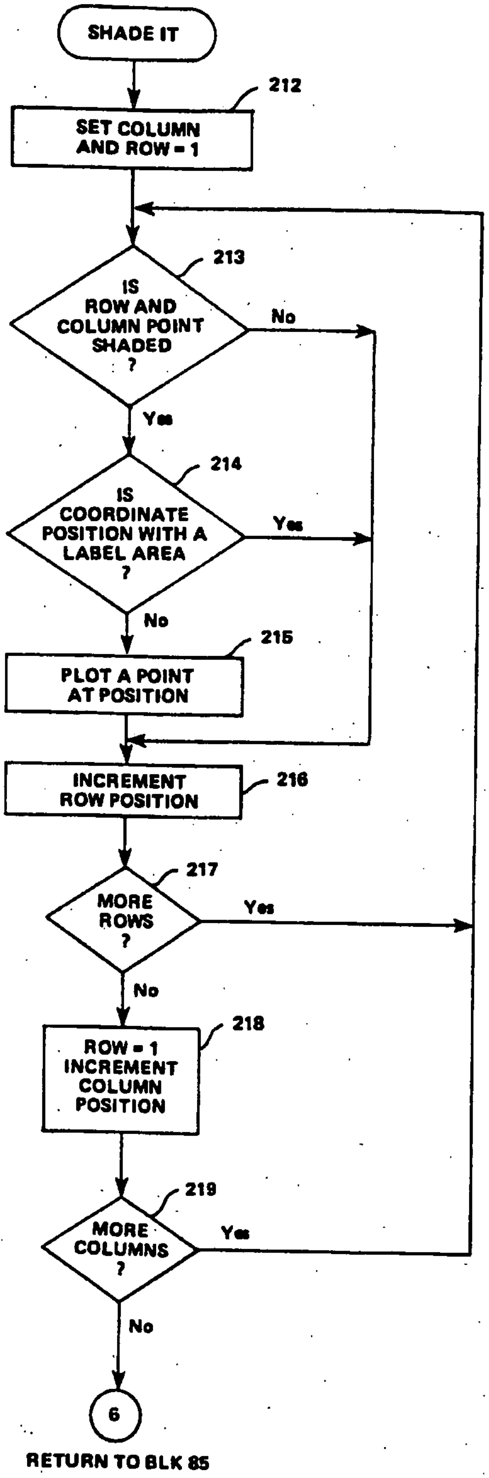

SHADE IT
212
SET COLUMN AND ROW = 1
213
IS ROW AND COLUMN POINT SHADED ?
No
Yes
214
IS COORDINATE POSITION WITH A LABEL AREA ?
Yes
No
215
PLOT A POINT AT POSITION
INCREMENT ROW POSITION
216
217
MORE ROWS ?
Yes
No
218
ROW = 1 INCREMENT COLUMN POSITION
219
MORE COLUMNS ?
Yes
No
6
RETURN TO BLK 85

FIG. 3P

COMPUTER-AIDED PROCESS FOR GENERATING CAMERA-READY GRAPHICAL ARTWORK

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

APPENDIX

An appendix consisting of 51 pages is included in this application.

BACKGROUND OF THE INVENTION

The present invention relates to graphic arts in general and more particularly to an improved process for automatically generating camera-ready graphical artwork with the aid of a computer.

Graphical artwork, more specifically, graphical plots are commonly used as a visual aid to display a substantial amount of information regarding the coordinate relationships of certain variable physical quantities. In addition to the plotting of the basic coordinate data, typically for selected values of a variable factor or condition, such graphical plots generally include a variety of reference lines or curves as well as shading patterns for ready observation and interpretation of the data. Large quantities of these highly informative graphical plots, often found in scientific works and technical reports and manuals, are usually printed using conventional methods of photolithography that require production of a high-quality reproduction copy of the graphical plots in intricate detail, ready for photographing by a process camera.

Commonly known as being camera-ready, such high-quality reproduction copies of the graphical plots have been difficult and time-consuming to produce as well as to edit and correct if necessary. Hand-drawing and editing of the plots by skilled draftsmen, although satisfactory from a quality standpoint, continues to be painstaking and costly. Machine-drawn plots can be produced in substantially less time and have generally been adequate in quality and detail. However, such machine-drawn artwork still requires manual "cut-outs" and "paste-ons" to meet camera-ready requirements.

SUMMARY OF THE INVENTION

Accordingly, it is a main purpose and general object of the present invention to provide an improved process implemented by a computer for generating graphical artwork of a finished quality ready for photolighographic reproduction.

It is a more particular object of the present invention to provide a computer-aided process for producing original camera-ready graphical plots in full detail without requiring any manual drafting labor.

It is a further object of the present invention to provide an automated process for creating revised camera-ready graphical plots that permits custom editing and correcting of existing plots quickly and precisely without manually redrawing revisions and affixing those revisions to the existing plots.

It is a still further object of the present invention to provide a computer-aided process for graphical artwork generation that is cost effective, reliable in performance, and easily adapted to existing automated graphic art equipment.

Briefly, these and other aspects of the present invention are accomplished by a computer-aided process for automatically generating a camera-ready hardcopy of a graphical plot upon command instructions inputted via a conventional storage tube graphics display terminal having an addressable cross hair cursor and a keyboard. In accordance with an interactive graphics code or program, tabular data coordinates stored in computer file form are retrieved and plotted on appropriately titled and scaled axes with the plotted coordinates being interconnected along curves formed of a smooth or linear nature by interpolation. The graphical plot viewed on the display terminal is further enhanced by inclusion of labels, shaded areas, and reference symbols and characters prior to printing out the hardcopy on an associated hardcopy unit coupled to the display terminal.

For a better understanding of these and other aspects of the present invention, reference may be made to the following detailed description taken in conjunction with the accompanying drawings in which like reference numerals designate like parts throughout the figures thereof.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a general block diagram showing the hardware used to implement the process for automatically generating camera-ready graphical plots in accordance with the present invention;

FIG. 2 is a general flow diagram of the computer-aided process of the present invention, showing the broad stages of data processing steps and their standard sequence; and

FIGS. 3A-3P, inclusive, represent a more detailed flow diagram of the computer-aided process in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, the process for automated graphics generation according to the present invention is primarily aided and implemented by a general purpose digital computer system **10** serving as the host and programmed to operate in accordance with an interactive graphics code, described in greater detail hereinafter..

It should be noted that the interactive graphics code, used by the host computer system **10** to interpret and perform the interactive requests of the user is also described in the Appendix, which is the source code listing of the interactive graphics code written in FORTRAN IV. This source code listing of the instructions, routines, and other contents of the interactive graphics code in appropriate sequence may be implemented, for example, on a CDC Cyber Model 175 computer using a FORTRAN computer CDC Version 438, a linker/loader CDC Version 1.5538 for Network Operating System (NOS) 1.4, and a library module TEKTRONIX Plot 10.

Stored with sets of tabular data coordinates in computer file form, digital computer system **10** is coupled to a conventional storage tube graphics display terminal **12** which accepts data from and sends data to the computer system. Display terminal **12** is equipped with a screen **14** on which output from computer system **10** is displayed to a user, the screen being the face of a storage tube device (not shown), typically a cathode ray tube (CRT), which maintains a display once written, for an indefinite period of time until an erasure is made. Display terminal 12 is further provided with a control panel 16 on which a keyboard 18 is located for allowing the user to enter alphanumeric (A/N) data onto the screen 14 and onto the computer system 10. A cursor control 22 also located on the control panel 16 is employed by the user to address a graphic cross-hair cursor 20 movable across screen 14 to specify positional input of data. The display terminal 12 with the aforedescribed features is a commercially available unit, one suitable such unit being the Tektronix Model 4015 with its associated graphics software. A conventional hardcopy unit 24 compatible with display terminal 12 is coupled thereto for producing, in accordance with the present invention, a camera-ready, hardcopy 26 of a graphical plot produced on the screen 14.

Referring now to FIG. 2, Block 31 represents a general start up procedure in which the user establishes communication with the host computer system 10 and commands use of old data files and eventually begins execution of the interactive graphics code. Block 31 is a query as to creating a new data file or using the old one. If the user's response is new data, then a query for axis labels and other minimum graphical data is indicated. In Block 31, the old data is automatically inputted into storage along with labels and other information. Block 33 is the top of the interactive loop in which the user physically moves the coordinates on screen 14 via cross-hair cursor 20 and keys a single character on keyboard 18. This single character and the coordinates comprise a user command. Block 33 additionally performs other data checks such as, if this is a new plot (no data to plot), a create line command is automatically executed. Block 34 checks for a valid command. An invalid command sends control back to block 33. Blocks 35 thru 38 interpret the command, use the coordinate data, if required, and act appropriately on the plot.

Three groups of commands are available: label, coordinate and plot. Block 36 only concerns labeling. Block 37 concerns only line forming, coordinate points and shading. Block 38 concerns the general plot attributes, such as size, grid and line types. Block 39 thru 46, inclusive, follow a command to plot the data. Block 39 uses the minimum and maximum data ranges and the grid requirements, and picks an appropriate scale on each axis, finally plotting the axis and labels. Block 40, besides plotting other labels, saves the four coordinate points around the label for later use. Blocks 41 thru 44, inclusive, are concerned with lines on the plot. Options are available for smooth curve, linear, or just symbols. In addition, lines can be one of 9 dash line types with options for solid thick or thin lines, as well as closed or open curves. Block 45 plots the grid as specified and uses the label coordinate point data generated in block 40 such that no grid line extends thru a label. Block 46 completes the plot by determining shading regions and plotting them with a uniform grid of dots again avoiding shading of labels. The end result of block 46 is that the user has on the screen 14 the latest edited plot. At this point control is transferred to block 33 for more editing or termination of the plot.

Referring now to FIG. 3A, in Block 50 the user turns on the display terminal 12, connects to the host computer system 10 and begins execution of the interactive graphics code. Block 51 prompts the user as to product and date of version of the graphics code. In addition, a query is issued for a communication transmission rate with the host computer system 10. In block 52, the user picks an appropriate code number 1–4, indicating the desired rate of character transmission or baud rate. For example, codes 1–4 typically designate baud rates of 1200, 2400, 4800 and 9600 characters per second, respectively. Block 53 checks the baud rate code and passes to block 54 if valid; otherwise, the process moves back to block 52. Block 54 makes a read attempt to determine if the user has connected through the host computer system 10 another file containing an old plot data set. Block 55 checks this read and if an end of file was found, then a new plot is implied and the user is prompted for minimum data (plot axis labels for storage) in block 57. Block 58 queries the user for decimal places for each data group. These data are those generated during the plot creation and used to generate a data file of the created plot for storage in the files of the host computer system 10. Blocks 59 and 60 check and query the user for these data. Referring back to the other branch of block 55, in block 56 old plot data is read from file storage and readied for use. Block 61 sets the communications transmission rate and the character size on the screen 14 of display terminal 12 to small. Block 62 begins the interactive plotting in subroutine TIGPPR. Block 63 sets the grid and range of data to either user input values or default. The default data range is the minimum and maximum values of the X and Y data, respectively. Block 64 initializes a set of points to the serial coordinate data forming a linked list. The linked list is used to efficiently add or delete a coordinate data point to a line or shaded area. Block 65 sets the graphics software associated with the display terminal 12 for use of stroke generated characters rather than a composite (one of four fixed size horizontal characters). This is required in order to generate labels at any size and rotation. Block 66 operates on the linked list, determines the number of lines and where each line begins in the linked list data storage.

Referring now to FIG. 3B, block 67 checks the number or coordinate points and, if it is zero (a new plot), the user is prompted and sent to the command mode. If data exists, then a check is made in block 69 to see if this data has been plotted once. If not, block 70 prints the main plot label and GRID/DATA range values. A window on screen 14 (physical plot size) is now set in block 17. Block 72 checks the validity of data ranges. If they are not valid, block 73 computes minimum and maximum values, respectively. Block 74 determines data scaling parameters from minimum and maximum X and Y values. The scales being preset to multiples of 1, 2 or 5. Block 75 computes the scaling of real units to the screen units, typically 4096×4096, on the display terminal 12. Block 76 checks for first time plot and gives the user a chance to change size, grid and other parameters. Blocks 77, 78 and 79 are reference to respective subroutines for drawing curves and labels, shown in greater detail in FIGS. 3L, 3M and 3O, respectively. Blocks 80 thru 83 determine if default axis labels are drawn, and draw all other labels using the subroutine PTITE, shown in greater detail in FIG. 3M.

Referring now to FIG. 3C, block 84 checks for existence of shading. If shading exists, then subroutine SHADIT, shown in FIG. 3P, is called in block 85. Similarly, both X and Y Grid requirements are checked and subroutines PGRIDX and PGRIDY shown in FIG. 3N are called as needed. Block 90 turns off the stroke characters since they are not needed in the command mode.

Referring now to FIG. 3D, in block **91**, the user physically positions the movable cross-hair cursor **20** to a position on screen **14** after which a single character on keyboard **18** is depressed. The character depressed is used to determine the coordinate command and the position of the cross-hair cursor **20** on screen **14** used to compute a coordinate position X and Y. Block **92** checks for a valid command by performing a table look-up using the ASCII code for the character keyed. The ASCII is the American Standard Code for Information Interchange, a standard code consisting of 7-bit elements for information interchange among data processing communications systems. Block **92** flags the character as invalid, i.e. illegal, and re-prompts user in block **91**. A valid coordinate command from the user continues the process as desired, and such valid commands are as follows:

VALID COORDINATE COMMAND SUMMARY

COMMAND	DESCRIPTION
A	add point after reference point
B	add point before reference point
C	identify closest data point (to cross hairs)
D	delete data point
E	exit
F	format (change line type)
G	input grid data
H	halt graphics tablet mode
K	kill line with closest data point to cross hairs
L	ENTER label mode and locate closest label to cross hairs
M	MOVE identified data point to new position
N	input a new data point beginning a new line
P	re-plot the current data using same window scale
Q	quit label mode
R	repeat the current data (but resize it to fill screen)
S	show real values X and Y at current screen position
T	Enter graphic tablet mode
V	input direct coordinate values for X and Y
W	Window data P replot to new minimum and maximum values

The above coordinate commands, prefixed each respectively by the number "9", are shown in FIGS. 3E, 3F, 3G, 3H, 3J and 3K and are described in greater detail hereinafter with appropriate reference to those figures.

Referring now to FIG. 3E, block **94** checks to see if this is the first point of a new plot; if it is, then control is transferred to the appropriate coordinate command for inputting a new line. The command "A" (99A) basically adds a point in storage after a reference point, the reference point being set by the command "C" (9C), shown in FIG. 3F. Block **95** checks to see if the user had set a reference point, a transfer to block **93** indicating a point not set and an invalid command. Block **96** checks to see if the point is within the plot frame on the screen **14** of display terminal **12**. Block **90** plots a character indicating the line type at a coordinate position selected by the user. Block **98**, using the linked list storage, adds the new point into the list after the reference point, and changes the reference point to the new point just added. Coordinate command "B" (9B), also shown in FIG. 3E, follows the same logic as the "A" command except as to placement of the new point relative to the reference point. Via block **103**, the "B" command puts the point before the reference point in storage. The linked list is used the same way except the coordinate values are swapped so that the link list remains the same as in the A command mode.

Referring now to FIG. 3F, the "C" command (9C) establishes a reference point by finding the closes coordinate point per block **104**. Blocks **105** and **106** check the point and plot a line character symbol if the point is within the plot frame. Block **107** moves the linked list forward pointer to the next set of coordinate points and stores the positions and line number of the reference point. The "D" coordinate command (9D), also shown in FIG. 3F, deletes a coordinate point and performs the same operations in blocks **108**, **190** and **110** as the respective blocks **104**, **105** and **106** for "C" command. The "D" command differs, however, from the "C" command in that in Block **111** the point is deleted from the linked list. This is accomplished by moving the forward coordinate set, as pointed to by the forward pointer, to the deleted point position. The unused data storage space is then added to another linked list which is a list of unused storage. Block **112** turns off the reference pointer flag since the point was just deleted. The "E" or exit coordinate command (9E) is executed per block **113** which terminates the plot, returns to the main program, and converts the linked data to serial data and outputs the data with all corrections, labels and arrows to the file of host computer **10**.

Referring now to FIG. 3G, the "F" or format command (9F) can change the line characteristics in terms of linear, smooth, symbols only, no symbols, closed curve, or shade. The user positions the cross-hair cursor **20** either to the left or right of the vertical axis of the plot. Block **121** checks for this relative position of cursor **20**. If the position is to the left, block **122** is used and the line type and curve type are changed for all lines of the entire plot. If the cursor position is to the right of the vertical axis, block **123** is used and the format change only applies to the indicated line. The lines and associated symbols are listed in a column at the left top of the terminal display screen **14**. In block **115**, the vertical coordinate position is used to determine the closest line and symbol. The line number is derived from this operation. Blocks **116**, **117**, **118** and **119** check that value and keep it within the range of one to the maximum number of lines plotted. Block **120** prompts the user for the new line type value and new curve type value. Blocks **121**, **122** and **123**, as previously discussed, determine how to apply new line type and curve type.

The "G" command (9G), also shown in FIG. 3G is executed via block **124** and is used to change the grid format. The user selects the number of major and minor tick marks and the frequency of grid lines on both axes. Via block **125** the "H" Command (9H) is effected. The "H" command is used to terminate the tablet command mode, the tablet mode being analogous to the screen mode in the context of the command and coordinate entry. The "K" or kill command (9K) is executed via block **126** and **127** and is similar to the "D" or delete command except that the "K" command deletes the entire line.

Referring now to FIG. 3H, the "L" command (9L) enters the label mode via block **128**. The label mode keys a new set of single key commands which only affect labeling of the plot. The initial "L" command enters the label mode and uses the coordinate position to compute the closest label. The following is a summary of label mode commands:

LABEL MODE COMMAND SUMMARY

COMMAND	DESCRIPTION
L	Identify closest label and plot point showing its reference point
M	Move identified label to indicated cursor position
S	Change label size
D	Delete label
Q	Quit label mode return to coordinate mode
N	Add new label at current cursor position
A	Add arrow to plot
P	Print current identified label
C	Copy identified label to new cursor position
V	Move label to new vertical position
H	Move label to new horizontal position

These label mode commands, like the coordinate mode commands, are prefixed by the number "11" for designation in the drawing figures and are described hereinbelow.

In accordance with the "M" label mode command (11M), the user moves an identified lable to a described position using cursor **20**. The user is then prompted for two more coordinate points. These points are used to compute the slope of the label in block **131**. The label is then printed at the indicated position along the new slope. Block **132** represents the "S" label mode command (11S) used to change the size of a label. Block **132** also checks to insure that a label has been identified using the initial "L" command. Block **133** executes the "D" label mode command (11D), deleting the previously identified label. The "N" label mode command (11N) executed via block **134** inputs a new label and its attributes, i.e., justification and storage. Block **134** also prompts the user for 2 additional points required for slope computation. In block **135**, the "A" label mode command (11A) is implemented. The user positions the cursor **20** at the arrow tail (non-pointed end) and keys "A". Two additional points are requested giving a broken arrow with the final point as the arrow head.

Referring now to FIG. 3I, block **136** affects a "P" or print label command (11P). In accordance with block **136**, the current located label is re-printed. This provides a means for the user to identify which label is located when the initial "L" command is sued in clustered labels. Block **137** implements the "C" label mode command (11C), generating a copy of the identified label and promptly the user for two additional points to define the slope of the new copied label. The "V" label mode command (11V) implemented via block **138** is a quick label move to the indicated position, with the orientation vertical, reading from the bottom to the top on right side. Similarly, block **139** executes the "H" habel mode command (11H), performing an analogous label move, with the label set horizontal. Both the "V" and "H" label mode commands in blocks **138** and **139** are fast versions of the previously described "M" label mode command (11M). Block **140** represents the "Q" label mode command (11Q) that exits the label mode and returns the user to the coordinate command mode.

Referring now to FIG. 3J, the remainder of the coordinate commands are shown. In block **141**, the "M" coordinate command (9M) is executed, moving the previously identified coordinate point to a position as indicated by cursor **20**. Block **141** also checks to insure that a previous point has been identified as the reference point via the "C" coordinate command and block **104**. Block **142** prompts the user for a new line value as well as line and curve type in accordance with the "N" coordinate command (9N). The coordinate point at the cursor **20** is identified as the first point of the new curve. In addition the reference point is automatically set to the new point.

The "P" plot coordinate command (9P) is executed in a series of steps represented by blocks **143–146**. The first step of the "P" coordinate command, taken in block **143**, is to determine the vertical position of the cross-hair cursor **20**. If the position is to the right of the vertical axis, then control is transferred to block **65** to FIG. 3A, causing the graphics code to replot the data. If the cursor **20** is to the left of the vertical axis then further checks are performed. In block **144**, a check is made to see if the line values and symbols have been already listed, i.e., in column format, left of vertical axis. Block **147** lists these line values and symbols if they have not been listed and in block **145** the line value of the closest line, listed in block **146**, to the cursor **20** is determined. This closest line is toggled to plot in the next "P" command, and gives the user the capability to edit, plot and correct several lines overlapping on each other by plotting each one separately. The "P" command based on position of cursor **20** left of the vertical axis, can be thought of as a pick to live to plot command. In block **148** the "R" or restore/reset coordinate command (9R) is initiated. As with the "P" command and block **143**, the vertical coordinate position of cursor **20** is used to determine the effect of the command. To the left of the vertical axis, the "R" command restores all lines to plot visibility. To the right, the "R" command resizes the plot to fit the minimum and maximum values contained within the coordinate data. In block **150**, the "S" or "show" coordinate command is executed, the coordinate values being used to compute the actual real units at the cross-hair location of cursor **20** and these values being displayed on the screen **14**. In block **151**, the control is transferred, in accordance with the "T" coordinate command (9T), to the graphics tablet using a "mouse" to position and key coordinate commands.

In FIG. 3K, block **152** initiates the "V" coordinate command (9V). The "V" command is similar to the "A" or add point command except that the user directly inputs the exact values. Block **152** checks for a reference point and block **154** prompts the user for one set of coordinate values. Block **155** prompts the user to store before or after the reference point. Block **157** resets the new point to the reference point and transfers to the next command. Block **158** initiates the "W" or window coordinate command. In this command, the user is prompted for two sets of coordinate points from which a rectangular window is formed and the plot size enlarged to fill screen **14** with data in that window. Block **158** gets the first set of coordinate points and block **160** checks for closeness of the two sets of coordinate points. Block **161** uses the two sets and redraws the plot enlarged on that window. Block **162** is transferred to when the user has not moved the cursor **20** for the second set of coordinate points, implying that direct input of window coordinate points is being requested. Block **162** performs this request. Block **163** computes minimum and maximum values and transfers to replot the data with the newly specified minimum and maximum.

Referring now to FIG. 3L, the DRAWIT subroutine is shown. In block **164** the shading storage, a bit map representation of the entire screen **14** is set to zero i.e., no shade. Block **165** determines the line type, curve or linear, and block **166** plots the symbols, if required. Block **167** determines the line mode, solid or dashed. Block **168** begins to plot the curve, determining if symbols at each coordinate point are required, and block **169** instructs the plotting of the symbols. Via block **170**, if the curve type is linear, then a straight line is drawn between data points. Data interpolation using the Hiroshi Akima technique is executed via block **172**, using all the points on the given line and generating short line segments. Block **173** determines the type of line, i.e., dashed, solid or shaded. Block **174** plots the line as dashed using one of several different pre-programmed dash sequences. Block **175** imposes the shading on the plot using the following algorithm: in block **164**, a bit map representation of the plot is initialized (about 20,000 points per plot); as the curve in which shading was requested is drawn, the points in the columns beneath the curve are examined; if a point (single bit) is not already shaded (bit is zero), then it is set to shade (bit set to 1); conversely if the bit is set to shade (bit equals 1), then it is reset to no shade (bit equals 0). This algorithm permits any shape defined by a curve, open or closed to be shaded. Further related discussion is found hereinafter regarding the subroutine SHADE. Block **176** determines if the wide solid line is required and block **177** plots the wide curve by performing a "hem stitch" motion as the curve is drawn. Block **178** simply draws the regular line, single width. Block **179** checks to see if any more lines are to be drawn, and if not returns control to block **77** in FIG. 3B.

Referring now to FIG. 3M, the PTITLE subroutine (plot titles) is shown. Block **180** gets the size of the title as inputted or changed by the user. Block **181** uses the two slope points also inputted by the user to compute the title angle. Block **183** eliminates all leading blanks from the label. Block **183** begins scanning the title for three consecutive blanks used as a signal to terminate this line and begin a new line. Block **184** does the termination. Likewise, if the scan does not find three consecutive blanks, then the entire title is assumed on one line. Block **186** checks user input to see if title is centered or left shifted. Block **189** plots the title and increment to the next line. Block **190** checks the length of the line and stores the maximum line length. Block **192** checks for more title lines in the same title and transfers when finished to block **193**. Block **193** stores the maximum line length and computes four coordinates around the title and stores these for later use. FIG. 3N shows the flow for the grid drawing subroutine PGRIDY/PGRIDX. Block **194** determines which grid lines are to be drawn. Block **195** moves into position to begin the grid line on either axis. Block **196** computes all possible intersections of this line with all title boundaries as determined in the PTITLE routine of FIG. 3M. False crossings are eliminated and the sequence of real crossings is stored in the order of crossing. Block **197** initializes the position and counter while block **198** determines if the end of the current grid line is reached. Block **203** checks for more grid lines if the current end is reached. Block **199** computes the next intersection of the grid line with the next title boundary it crosses and block **200** checks to see if drawing from the current position to intersection is crossing a title block. If it is, then block **201** skips drawing and moves to the computed intersection. Block **202** is used to draw a line to the intersection when a line is not passing thru title. This process is repeated looping back thru to block **198** until the end of the current grid line is reached.

Referring now to FIG. 3O, the SHADE subroutine is described. Block **204** checks for the first point of a line segment and block **205** stores it. In succeeding passes thru SHADE control is transferred to block **206**. Block **206** takes two points and examines all columns of points between the X-axis and the line spanning the interval of the points. Within each column beneath this interval each possible shade point is checked. If the point is already shaded, it is unshaded and similarly, a point unshaded is shaded. This process is repeated until the line is traversed to its end. Also in FIG. 3O, the AXIS subroutine is shown. Block **211** uses the minimum and maximum values determined from the coordinate data and generates sealing in a multiple of 1, 2 or 5 units. Tick marks and numbers required on axis are computed and plotted.

Referring now to FIG. 3P, subroutine SHADEIT is shown. SHADEIT actually plots the points assembled with the SHADE subroutine shown in FIG. 3O. The exception is that points within a title block are omitted from shading. Block **212** sets the column row position and begins checking all 20,000 possible points. Block **213** checks point for shade. If point is shaded block **214** checks to see if shaded point is within label. If not, block **215** plots the point and block **216** increments the row counter. Block **217** checks for more rows and block **218** resets to Row 1 and moves to the next column. Block **219** then checks for more columns, and if none are found, return to block **85**.

Therefore, it is apparent that the present invention provides an improved process implemented by a computer for generating graphical artwork of a finished quality ready for photolithographic reproduction. More particularly, the present invention provides a computer-aided process for producing original camera-ready plots in full detail without requiring any manual drafting. Furthermore, the disclosed invention provides an automated process for creating revised camera-ready graphical plots that permits custom editing and correcting of existing plots quickly and precisely without manually redrawing revisions and affixing them to existing plots. In addition, the disclosed computer-aided process for graphical artwork generation is cost effective, reliable in performance, easily adapted to existing automated graphic art equipment.

Obviously, other embodiments and modifications of the present invention will readily come to those of ordinary skill in the art having the benefit of the teachings presented in the foregoing description and drawings. It is therefore to be understood that various changes in the details, materials, steps, and arrangement of parts, which have been described and illustrated to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

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APPENDIX

FORTRAN LISTING

```
CUTIGS
                                                                   TIGS000
C*** USE P4662 PROC FILE
      PROGRAM UTIGS(INPUT=101,OUTPUT,TAPE1=101,TAPE7=101,TAPE5=INPUT)    TIGS0003
C ***********************************                                   TIGS0004
C****                                                                   TIGS0005
C****       ULTRA TIGS TPLOT INTERACTICE GRAPHICS SYSTEM
C****                                                                   TIGS0007
C**** M CADDY REVISED SEP 82
      COMMON/ITITLE/ITT(50),JTT(50),KTT(50),LTT(50),MTT(50),STT(50),
     1 XTT(50),YTT(50),XUU(50),YUU(50),XVV(50),YVV(50),ITC(8,50),NTITE
     2 ,AXMIN,AYMIN,AXMAX,AYMAX,IXDEN,IYDEN,IGRIDX,IGRIDY,ITMX,ITMY,
     3 ICHAR,IWIN
      DIMENSION LT(7),XV(50),NPTS(50),X(1000),Y(1000),Z(50),A(200)
      DIMENSION IRATE(4)
      DATA NPLOT/0/                                                     TIGS0010
      DATA NPTS,XV/50*0,50*0./                                          TIGS0015
      DATA IEND/10HEOT        /                                         TIGS0014
      DATA IRATE/120,240,480,960/
   10 FORMAT(A5,7A10)                                                   TIGS0015
      REWIND 1                                                          TIGS0016
      REWIND 7                                                          TIGS0017
      PRINT *,"UTIGS VER 1.0 02-08-83     DEFAULT IS 9600 BAUD"
      PRINT *,"AND MAXIMUM DECIMALS ON TAPE7 OUTPUT"
      PRINT *, "ENTER C R> TO CHANGE OR  R> TO CONTINUE"
      IBR=960
      IDFLT=1
      READ 30,IBZ
      IF(EOF(5).NE.0.)GO TO 29
      IDFLT=0
      PRINT 21
   21 FORMAT(* ENTER BAUD RATE CODE *,/,
     1 * 1=1200; 2=2400, 3=4800, 4=9600*)
      CALL GETIN(1,Z(1))
      IER=Z
      IBR=MAX0(1,MIN0(IER,4))
      IER=IRATE(IBR)
C****                                                                   TIGS0024
C****       FILE IS NOT BEING CREATED READ IT FROM TAPE1                TIGS0025
C****                                                                   TIGS0026
   29 IC=0
   30 FORMAT(1R1)
   31 READ (1,10) LNO,LT                                                TIGS0027
      IF(EOF(1).EQ.0.)GO TO 32
      IC=1
      PRINT *,"CREATION MODE"
      GO TO 40
   32 IF(LNO.EQ.10H           ) GO TO 251
C****                                                                   TIGS0028
C****       CALL IN 2 VALUES                                            TIGS0029
C****                                                                   TIGS0030
      CALL TABR(LZ,L,MT,NZ,Z,1)
C****                                                                   TIGS0032
C****       READ IN Y,X,FXYZ DATA FOR NON CREATION RUN                  TIGS0033
C****                                                                   TIGS0034
      CALL TABR(LY,L,MT,NY,A,1)
      CALL TABR(LX,L,MT,N,X,1)
C*** SAVE STORAGE LOCATION OF LAST X VALUE
      JXS=0
      CALL TABR(LF,L,MT,K,Y,1)
      MTT(1)=MT
      LTT(1)=L
      GO TO 100
   40 PRINT 50
   50 FORMAT(* ENTER TABLE TITLE CARD*/,
     1 * (COLUMNS 1-5 SHOULD BE THE TABLE REFERENCE NUMBER)*)
      READ 10,LNC,LT
C****
C****        READ TABLE NUMBER AND TITLE
C****
      PRINT 60
   60 FORMAT(* ENTER 4 CHARACTERS FOR EACH LABEL FOR Z,Y,X,FXYZ*/
     1 * (SEPARATED BY COMMAS)*)
C****
C****        READ TITLES FOR EACH VARIABLE 4 CHARACTERS LONG
C****
      READ 70,LZ,LY,LX,LF
   70 FORMAT(4(A4,1X))
C****
C****        GET NUMBER OF Z VARIABLES AND VALUES
C****
      PRINT 80,LZ
   80 FORMAT(* ENTER NUMBER OF *,A4,* VARIABLES---- FREE FORM*)
      CALL GETIN(1,Z)
      NZ=Z(1)
      PRINT 90,LZ
   90 FORMAT(* ENTER *,A4,* VALUES ,ASCENDING ORDER--FREE FORM*)
      CALL GETIN(NZ,Z)
C****
C****        WRITE TO TAPE7 TITLE CARD AND TABLE NUMBER
C****
  100 WRITE(7,10) LNC,LT
      ICPTD=0
      IF(IDFLT.EQ.1)GO TO 99
      PRINT 101
  101 FORMAT(* WANT TO SPECIFY DECIMAL PLACES ON TAPE7?*)
      READ 30,ICPTD
   99 DO 102 ISET=1,4
  102 XV(ISET)=0.
      IF(ICPTD.NE.31B)GO TO 115
      PRINT 110,LZ,LY,LX,LF
  110 FORMAT(* ENTER NUMBER OF DECIMAL PLACES FOR *,4(A4,1X)
     1 ,* FREE FORM*)
C****
C****        GET NUMBER OF DECIMAL PLACES FOR EACH VARIABLE
C****
      CALL GETIN(4,XV)
  115 LZDP=XV(1)
      LYDP=XV(2)
      LXDP=XV(3)
      LFDP=XV(4)
C****
C****        WRITE TO TAPE7 THE Z VALUES ETC...
C****
      CALL TFORM(1,LZ,NZ,0,0,Z,LZDP,7)
C****
C****        INIALIZE TEK SOFTWARE
C****
      CALL INITT(IBR)
      CALL TERM(3,4096)
      CALL CHRSIZ(4)
      NTITE=0
      DO 250 IZ=1,NZ                                                    TIGS0089
      IWIN=0
C****                                                                   TIGS0090
C****         IF CREATION MODE THEN SET DEFAULTS TO 0                   TIGS0091
C****                                                                   TIGS0092
      IF(IC.NE.1) GO TO 120                                             TIGS0093
      NPTS(1)=0                                                         TIGS0094
      X(1)=0.                                                           TIGS0095
      Y(1)=0.                                                           TIGS0096
      GO TO 210                                                         TIGS0097
C****                                                                   TIGS0098
C****         NON CREATION MODE                                         TIGS0099
C****                                                                   TIGS0100
  120 CONTINUE                                                          TIGS0101
      K=1                                                               TIGS0102
C****                                                                   TIGS0103
C****         TRANSFER SECOND INDEPENDENT VARIABLE TO XV ARRAY          TIGS0104
C****                                                                   TIGS0105
      DO 129 J=1,50
  129 XV(J)=0.
      DO 130 J=1,NY                                                     TIGS0106
  130 XV(J)=A(J)                                                        TIGS0107
      LNX=N                                                             TIGS0111
      LNY=N                                                             TIGS0112
      NPTS(1)=N                                                         TIGS0113
      NPTS(2)=0                                                         TIGS0114
          IF(IZ.EQ.1) GO TO 150
          LNX=0
          LNY=0
          K=0
C****                                                                   TIGS0115
C****         READ NEXT SET                                             TIGS0116
C****                                                                   TIGS0117
  150 READ (1,188) LABI,ITI,JTI,KTI,(A(I),I=1,7)
  188 FORMAT(A4,3I1,3X,7F10.4)
      IF(LABI.EQ.4H....)GO TO 189
      IF(LABI.NE.4H...C) GO TO 187
      READ (1,*)IXDEN,IYDEN,ITMX,ITMY,IGRIDY,IGRIDX,AXMIN,AYMIN,
     1AXMAX,AYMAX
      IWIN=1
      GO TO 150
  187 BACKSPACE 01
      GO TO 149
  189 NTITE=NTITE+1
      IF(NTITE.LE.50)GO TO 500
      CALL ANMODE
      PRINT *,"WARNING 50 LABEL MAX HAS BEEN EXCEEDED UTIGS ABORTED"
      STOP
  500 READ (1,191) (ITC(I,NTITE),I=1,8)
  191 FORMAT(8A10)
C****
C**** ITT= FLAG =1 TITLE NOT CENTERED =0 TITLE IS CENTERED
C**** JTT= UNITS FLAG  =1 USE REAL UNITS =0 USE SCREEN UNITS
C**** KTT= FLAG KTT=1 TITLE IS AN ARROW
C**** THE NEXT 6 INPUTS ARE 3 PSIRS OF COORDINATES
C**** THE FIRST = X,Y CENTERED PAIR
C**** THE SECOND IS A VECTOR USED FOR THE SLOPE
C**** THE THIRD IS ONLY USED FOR THE ARROW
C**** IF ARROW THE SECOND IS USED AS THE SECOND (KNEE) POINT
C**** OF THE ARROW.
      ITT(NTITE)=ITI
      JTT(NTITE)=JTI
      KTT(NTITE)=KTI
      STT(NTITE)=A(1)
      XTT(NTITE)=A(2)
      YTT(NTITE)=A(3)
      XUU(NTITE)=A(4)
      YUU(NTITE)=A(5)
      XVV(NTITE)=A(6)
      YVV(NTITE)=A(7)
      GO TO 150
  149 CALL TABR(LW,L,NT,N,A,1)
C****                                                                   TIGS0119
C****       CHECK FOR NEXT Z GROUP                                      TIGS0120
C****                                                                   TIGS0121
      IF(LW.NE.LY) GO TO 151                                            TIGS0122
      NY=N
      GO TO 210
C****                                                                   TIGS0123
C****       CHECK FOR END OF TABLE                                      TIGS0124
C****                                                                   TIGS0125
  151 IF(LW.EQ.4HEOT ) GO TO 210                                        TIGS0126
C****                                                                   TIGS0127
C****       CHECK FOR NEXT X DATA                                       TIGS0128
C****                                                                   TIGS0129
      IF(LW.NE.LX) GO TO 170                                            TIGS0130
C****                                                                   TIGS0131
C****       DATA IS X DATA STORE IT                                     TIGS0132
C****                                                                   TIGS0133
      JXS=LNX
      DO 160 J=1,N                                                      TIGS0135
      LNX=LNX+1                                                         TIGS0136
  160 X(LNX)=A(J)                                                       TIGS0137
      GO TO 150                                                         TIGS0138
C****                                                                   TIGS0139
C****       DATA HAD BETTER BE LY                                       TIGS0140
C****                                                                   TIGS0141
  170 IF(LW.NE.LF) STOP                                                 TIGS0142
C****                                                                   TIGS0143
C****       IF DATA HAS NOT BE INPUT FOR X DATA USE LAST VALUES         TIGS0144
C****                                                                   TIGS0145
      IF(LNX.GT.LNY) GO TO 190                                          TIGS0146
      LJS=JXS
      DO 180 J=1,N                                                      TIGS0148
      LNX=LNX+1                                                         TIGS0149
      LJS=LJS+1
  180 X(LNX)=X(LJS)                                                     TIGS0151
C****                                                                   TIGS0152
C****       UPDATE COUNTERS                                             TIGS0153
C****                                                                   TIGS0154
  190 K=K+1                                                             TIGS0155
      NPTS(K)=N                                                         TIGS0156
      NPTS(K+1)=0                                                       TIGS0157
C****                                                                   TIGS0158
C****       LOAD Y DATA                                                 TIGS0159
C****                                                                   TIGS0160
C*** CHECK FOR 50 LINE LIMIT
C****
      IF(K.NE.49) GO TO 202
      CALL ANMODE
      PRINT *,"NUMBER OF LINES EXCEED 49 UTIGS ABORTED"
      STOP
  202 IF(LNY+N.LE.1000) GO TO 199
      CALL ANMODE
      PRINT *,"NUMBER OF POINTS EXCEED 1000 LIMIT UTIGS ABORTED"
      STOP
  199 DO 200 J=1,N                                                   TIGS0161
      LNY=LNY+1                                                      TIGS0162
  200 Y(LNY)=A(J)                                                    TIGS0163
      MTT(K)=MT
      LTT(K)=L
C****                                                                TIGS0164
C****       GO BACK TO GET NEXT GROUP                                TIGS0165
C****                                                                TIGS0166
      GO TO 150                                                      TIGS0167
C****                                                                TIGS0168
C****       PLOT DATA                                                TIGS0169
C****                                                                TIGS0170
  210 IGRID=L
      CALL TIGPPR(NPLOT,LF,1,LX,1,LT,7,X,Y,NPTS,LY,1,XV,LYDP,ITIP,   TIGS0171
     1 IGRID,LZ,Z(IZ))                                               TIGS0172
      CALL ANMODE                                                    TIGS0173
C****                                                                TIGS0174
C****       COUNT NUMBER OF Y VALUES                                 TIGS0175
C****                                                                TIGS0176
      JY=0                                                           TIGS0177
      DO 220 I=1,50                                                  TIGS0178
      IF(NPTS(I).EQ.0) GO TO 230                                     TIGS0179
      JY=JY+1                                                        TIGS0180
  220 CONTINUE                                                       TIGS0181
      GO TO 250                                                      TIGS0182
C****                                                                TIGS0183
C****       WRITE TO TAPE7 Y DATA ETC....                            TIGS0184
C****                                                                TIGS0185
  230 CALL TFORM(1,LY,JY,0,0,XV,LYDP,7)
      LCC=1                                                          TIGS0187
      J=0                                                            TIGS0188
  240 J=J+1                                                          TIGS0189
      NP=NPTS(J)                                                     TIGS0190
      IF(NP.EQ.0) GO TO 250                                          TIGS0191
C****                                                                TIGS0192
C****       WRITE TO TAPE7 X DATA ETC...                             TIGS0193
C****                                                                TIGS0194
      CALL TFORM(LCC,LX,NP,0,0,X,LXDP,7)
C****                                                                TIGS0196
C****       WRITE TO TAPE7 Y DATA ETC...                             TIGS0197
C****                                                                TIGS0198
      CALL TFORM(LCC,LF,NP,LTT(J),MTT(J),Y,LFDP,7)
      LOC=LCC+NP                                                     TIGS0200
      GO TO 240                                                      TIGS0201
  250 CONTINUE                                                       TIGS0202
      WRITE(7,188)4H...C
      WRITE(7,*)IXDEN,IYDEN,ITMX,ITMY,IGRIDY,IGRIDX,AXMIN,AYMIN,
     1AXMAX,AYMAX
C*** CHECK FOR TITLES IN FILE
      IF(NTITE.LT.1) GO TO 310
      LABI=4H....
      DO 300 I=1,NTITE
      WRITE(7,188)LABI,ITT(I),JTT(I),KTT(I),STT(I),XTT(I),YTT(I),XUU(I),
     1 YUU(I),XVV(I),YVV(I)
  300 WRITE(7,191) (ITC(J,I),J=1,8)
  310 WRITE (7,10) IEND                                              TIGS0203
C****
C**** IF NON CREATION MODE THEN GO BACK TO READ NEXT TITLE
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C****
      IF(IC.NE.1) GO TO 31
  251 WRITE (7,10)                                                      TIGS0204
      REWIND 7                                                          TIGS0205
      END                                                               TIGS0206
CTFORM
                                                                TFOR0001
      SUBROUTINE TFORM(LOC,LAB,N,L,LM,X,IPI,K)
      DIMENSION X(1),IFORM(4)                                           TFOR0003
C****       FORMATTING SUBROUTINE FOR TPLOT FORMAT                      TFOR0004
C****       LOC IS THE LOCAL ARRAY POSITION TO PRINT FROM               TFOR0005
C****       LAB IS THE 4 CHARACTER LABEL                                TFOR0006
C****       N IS THE NUMBER TO PRINT                                    TFOR0007
C****       X IS THE ARRAY CONTAINING THE VALUES                        TFOR0008
C****       IP IS THE NUMBER OF DECIMAL PLACES TO USE IN FORMAT         TFOR0009
C****       IF IP=0 THEN MAXIMUM NUMBER OF DECIMAL PLACES WILL RESULT
      IP=IPI
      IF(IP.NE.0)GO TO 20
      XMAX=0.
      IF(N.LE.1)GO TO 20
      DO 10 I=1,N
      IF(X(I).EQ.0.)GO TO 10
      XC=ALOG10(ABS(X(I)))
      IF(XC.GT.XMAX) XMAX=XC
   10 CONTINUE
      IP=7-IFIX(XMAX)
   20 IF(IP.LT.0) IP=0                                                  TFOR0010
      IF(IP.GT.7) IP=7                                                  TFOR0011
      JO=LOC-1                                                          TFOR0012
      IFORM(1)=10H(A4,I3,
      IFORM(3)=24343456420634335733B+IP                                 TFOR0016
      IFORM(4)=10H))
      IF((L+LM).EQ.0)GO TO 30
      IFORM(2)=10HI1,I2,(
      WRITE(K,IFORM) LAB,N,L,LM,(X(I+JO),I=1,N)
      RETURN
   30 IFORM(2)=10H   3X,(
      WRITE(K,IFORM) LAB,N,(X(I+JO),I=1,N)
      RETURN                                                            TFOR0021
      END                                                               TFOR0022
CTABR
                                                                TABR0001
      SUBROUTINE TABR(LAB,L,MT,N,A,K)
      DIMENSION A(1)
      READ(K,10) LAB,N,L,MT,(A(I),I=1,7)
   10 FORMAT(A4,I3,I1,I2,7F10.0)
      IF(N.GT.7) READ(K,20) (A(I),I=8,N)
   20 FORMAT(10X,7F10.0)
      RETURN
      END
CTIGP
                                                                TIGP0001
C                                                                       TIGP0002
C         TEK INTERACTIVE GPPR  M CADDY FEB 78                          TIGP0003
C                                                                       TIGP0004
      SUBROUTINE TIGPPR(NPLOT,LABY,N1,LABX,N2,LABTL,NT ,X,Y,            TIGP0005
     1 NPTA,LABVAL,NCC,VLABL,NDECVIN,ITIP,IGRID,LZ,ZVAL)                TIGP0006
      COMMON/ITITLE/ITT(50),JTT(50),KTT(50),LTT(50),MTT(50),STT(50),
     1 XTT(50),YTT(50),XUU(50),YUU(50),XVV(50),YVV(50),ITC(8,50),NTITE
     2 ,AXMIN,AYMIN,AXMAX,AYMAX,IXDEN,IYDEN,IGRIDX,IGRIDY,ITMX,ITMY,
     3 ICHAR,IWIN
      COMMON/TKTRNX/ITEKC(60)                                           TIGP0009
      DIMENSION X(200),Y(200),LABTL(7),NPTA(50),VLABEL(50),             TIGP0010
     1 LABX(5),LABY(5),VTEM(8),LABVAL(8),IQUICK(30),ISUB(1000),MSG7(29) TIGP0011
      DIMENSION MSG1(20),MSG2(22),MSG4(10),MSG5(10),MSG6(15),IALTM(6,2) TIGP0012
      DIMENSION IPPX(4,50),IPPY(4,50),XDUM(2)                       TIGP001
      EQUIVALENCE (BEG(1),XBEG),(BEG(2),YBEG)                           TIGP0014
      EQUIVALENCE (DEL(1),DELX),(DEL(2),DELY),(ITAB,LTV(2))             TIGP0015
      EQUIVALENCE (EN(1),XEND),(EN(2),YEND)                             TIGP0016
      EQUIVALENCE (IOFF,ITEKC(30)),(TXMIN,ITEKC(1))                     TIGP0017
C          SET LINE SPACING                                             TIGP0018
      COMMON/TEKGPPR/LDEL,LCNT,MAXSR,LTV(17),EN(2),DEL(2),BEG(2),RDX2,  TIGP0019
     1RDY2,NLINE,NDRAW(50)                                              TIGP0020
      DATA MSG1/46,46,80,111,105,110,116,101,114,32,                    TIGP0021
     1          80,111,115,105,116,105,111,110,101,100/                 TIGP0022
      DATA MSG2/73,110,112,117,116,32,76,105,110,101,                   TIGP0023
     1          32,86,97,108,117,101,44,76,84,44,77,84/                 TIGP0024
C**** ILLEGAL MESSAGE                                                    TIGP0025
      DATA MSG4/42,73,108,108,101,103,97,108,42,32/                     TIGP0026
      DATA MSG5/73,110,112,117,116,32,88,44,89,32/                      TIGP0027
      DATA MSG6/65,32,111,114,32,66,32,109,111,100,                     TIGP0028
     1          101,63,32,32,32/                                        TIGP0029
      DATA MSG7/69,78,84,69,82,32,87,73,78,68,79,87,13,10,              TIGP0030
     1 68,73,65,71,79,78,65,76,32,80,79,73,78,84,83/                    TIGP0031
      DATA ((IALTM(I,J),I=1,6),J=1,2)/65,102,116,101,114,32,            TIGP0032
     1                               66,101,102,111,114,101/            TIGP0033
      DATA IQUICK/0,0,1,1,2,3,10,4,0,0,                                 TIGP0034
     1          11,12,0,5,0,6,0,7,8,0,                                  TIGP0035
     2           0,0,9,0,0,0,0,0,0,0/                                   TIGP0036
      IXTOS(X)=((X-BEG(1))/DELX+600)                                    TIGP0037
      IYTOS(Y)=((Y-BEG(2))/DELY+300)                                    TIGP0038
      LDEL=50                                                           TIGP0039
      ICHAR=0                                                           TIGP0040
      IF(IWIN.EQ.1)GO TO 5
      IGRIDX=IGRID                                                      TIGP0041
      IGRIDY=IGRID                                                      TIGP0042
C**** DEFAULT AXIS
      IXDEN=6                                                           TIGP0101
      IYDEN=8                                                           TIGP0102
      ITMX=0
      ITMY=0
    5 IF(NPLOT.GT.0) GO TO 20                                           TIGP0043
      DO 10 I=1,8                                                       TIGP0044
   10 LTV(I)=0                                                          TIGP0045
C**20 IWIN=0                                                            TIGP0046
   20 NPLOT=NPLOT+1                                                     TIGP0047
      KLAST=0
      NTL=NT                                                            TIGP0048
      NLINE=0                                                           TIGP0049
   30 NSTOR=0                                                           TIGP0050
C         SET STORAGE POINTER TO INITIAL SEQUENCE                       TIGP0051
      DO 40 I=1,999                                                     TIGP0052
   40 ISUB(I)=I+1                                                       TIGP0053
C                                                                       TIGP0054
C     MERGE HERE TO REPLOT                                              TIGP0055
C                                                                       TIGP0056
   50 CALL SWCHAR(1)                                                    TIGP0057
      LCNT=3120                                                         TIGP0059
C          SUM UP NUMBER OF POINTS                                      TIGP0060
      NL=0                                                              TIGP0061
      NPTOT=0                                                           TIGP0062
      DO 60 I=1,50                                                      TIGP0063
      N=NPTA(I)                                                         TIGP0064
      IF(N.EQ.0) GO TO 70                                               TIGP0065
      NL=NL+1                                                           TIGP0066
   60 NPTOT=NPTOT+N                                                     TIGP0067
C         SET STORAGE LIMIT TO NPTOT FIRST PASS                         TIGP0068
   70 IF(NSTOR.EQ.0) NSTOR=NPTOT                                        TIGP0069
      IF(NPTOT.GT.0)GO TO 90                                            TIGP0070
      NSTOR=0                                                           TIGP0071
      CALL MOVABS(0,LCNT)                                               TIGP0072
      CALL ANMODE                                                       TIGP0073
      PRINT 80                                                          TIGP0074
   80 FORMAT(* NO DATA FOUND TO PLOT ..ENTER COMMAND*)                  TIGP0075
      LCNT=LCNT-LDEL                                                    TIGP0076
      IPLOT=0                                                           TIGP0077
      GO TO 280                                                         TIGP0078
   90 CONTINUE                                                          TIGP0083
      IDEN=0                                                            TIGP0085
C     PREPARE TEKTRONIX AGII COMMON                                     TIGP0086
C                                                                       TIGP0087
      IPLOT=IPLOT+1                                                     TIGP0089
      CALL CHRSIZ(2)                                                    TIGP0093
      IF(ICHAR.NE.0) GO TO 120                                          TIGP0094
      CALL ANMODE                                                       TIGP0095
      PRINT 110,LABTL                                                   TIGP0096
  110 FORMAT(* NEXT PLOT IS *,/,9A10)                                   TIGP0097
      IF(IWIN.NE.0)PRINT *,"GRID/WINDOW IS SET "
     1,IXDEN,IYDEN,ITMX,ITMY,IGRIDY,IGRIDX,AXMIN,AYMIN,
     2 AXMAX,AYMAX
      LCNT=LCNT-LDEL*3                                                  TIGP0098
C****                                                                   TIGP0099
C                                                                       TIGP0103
C      IF FIRST TIME AROUND.. GET COMMAND FIRST TO PLOT                 TIGP0104
C                                                                       TIGP0105
C           SET SCREEN WINDOW SIZE                                      TIGP0106
  120 CALL SWINDO(600,3360,300,2400)
      IF(IWIN.EQ.0) GO TO 125                                           TIGP0110
C**** THIS SETS KLAST PARAMETER IF NOT SET
      IF(KLAST.NE.0)GO TO 140
      K=1
      DO 121 I=1,NPTOT
      KLAST=K
  121 K=ISUB(K)
      GO TO 140
  125 AXMAX=-1.E99                                                      TIGP0111
      AYMAX=-1.E99                                                      TIGP0112
      AXMIN=+1.E99                                                      TIGP0113
      AYMIN=+1.E99                                                      TIGP0114
C          SET MIN AND MAX DATA VALUES                                  TIGP0115
      K=1                                                               TIGP0116
      DO 130 I=1,NPTOT                                                  TIGP0117
      AXMIN=AMIN1(AXMIN,X(K))                                           TIGP0118
      AYMIN=AMIN1(AYMIN,Y(K))                                           TIGP0119
      AXMAX=AMAX1(AXMAX,X(K))                                           TIGP0120
      AYMAX=AMAX1(AYMAX,Y(K))                                           TIGP0121
      KLAST=K                                                           TIGP0122
C        SET KLAST TO END STORAGE VALUE                                 TIGP0123
  130 K=ISUB(K)                                                         TIGP0124
      IWIN=1                                                            TIGP0125
  140 IF(AXMIN.NE.AXMAX)  GO TO 150                                     TIGP0126
      AXMIN=AXMIN-.5                                                    TIGP0127
      AXMAX=AXMAX+.5                                                    TIGP0128
  150 IF(AYMIN.NE.AYMAX) GO TO 160                                      TIGP0129
      AYMIN=AYMIN-.5                                                    TIGP0130
      AYMAX=AYMAX+.5                                                    TIGP0131
  160 CONTINUE
      XDUM(1)=AXMIN
      XDUM(2)=AXMAX
      AXL=IXDEN
      CALL AXSCALE(XDUM,AXL,2,XBEG,DELXX,0)
      XEND=XBEG+AXL*DELXX
      XDUM(1)=AYMIN
      XDUM(2)=AYMAX
      AXL=IYDEN
      CALL AXSCALE(XDUM,AXL,2,YBEG,DELYY,0)
      YEND=YBEG+AXL*DELYY
C                                                                   TIGP0158
C     FIND VIRTUAL SPACE TO SCREEN SPACE SCALING PARAMETERS         TIGP0159
C                                                                   TIGP0160
      DELX=(XEND-XBEG)/3360.                                        TIGP0156
      DELY=(YEND-YBEG)/2400.                                        TIGP0157
      RDX2=1./(DELX*DELX)                                           TIGP0161
      RDY2=1./(DELY*DELY)                                           TIGP0162
C          SET VIRTUAL WINDOW                                       TIGP0132
      CALL DWINDO(XBEG,XEND,YBEG,YEND)
      IF(ICHAR.EQ.0)GO TO 280                                       TIGP0164
      CALL DRAWIT(NL,NPTA,X,Y,ISUB,MTT,LTT)                         TIGP0169
      CALL CHRSIZ(4)                                                TIGP0168
      IF(IXDEN.LE.0)GO TO 172
      CALL AXIS
     1(600,300,3360,2400,IXDEN,0,XBEG,DELXX,EX,1,1,ITMX,0,.15)
  172 IF(IYDEN.LE.0)GO TO 174
      CALL AXIS
     1(600,300,3360,2400,IYDEN,1,YBEG,DELYY,EX,1,1,ITMY,0,.15)
  174 CALL SWCHAR(1)                                                TIGP0170
      ICH=KIN(.15*.873)
      ICV=1.6*ICH                                                   TIGP0172
      CALL PLCHAR(ICH,ICV)                                          TIGP0173
      IF(IXDEN*IYDEN.EQ.0)GO TO 190
      CALL PTITE(2280,3000,NT,LABTL,0,50,0.,IPPX,IPPY)              TIGP0174
      IF(NTITE.GT.1) GO TO 180                                      TIGP0175
      CALL PTITE(300,1500,N1,LABY,0,50,90.,IPPX,IPPY)               TIGP0176
  180 IF(NTITE.GE.1) GO TO 190                                      TIGP0177
      CALL PTITE(2280,100,N2,LABX,0,20,0.,IPPX,IPPY)                TIGP0178
  190 IF(NTITE.EQ.0)GO TO 250                                       TIGP0179
      DO 240 II=1,NTITE                                             TIGP0180
      IF(KTT(II).EQ.0)GO TO 210                                     TIGP0181
C**** ARROW CODE                                                    TIGP0182
C**                                                                 TIGP0183
      IA1=IXTOS(XUU(II))                                            TIGP0184
      IA2=IYTOS(YUU(II))                                            TIGP0185
      IB1=IXTOS(XVV(II))                                            TIGP0186
      IB2=IYTOS(YVV(II))                                            TIGP0187
      CALL MOVEA(XTT(II),YTT(II))                                   TIGP0188
      CALL DARROW(IA1,IA2,IB1,IB2)                                  TIGP0189
      DO 200 JJ=1,4                                                 TIGP0190
      IPPX(JJ,II)=1000000000                                        TIGP0191
  200 IPPY(JJ,II)=1000000000                                        TIGP0192
      GO TO 240                                                     TIGP0193
  210 DANGX=(XVV(II)-XUU(II))*SQRT(RDX2)
      DANGY=(YVV(II)-YUU(II))*SQRT(RDY2)
      ANG=0.
      IF(DANGY.EQ.0..AND.DANGX.EQ.0.) GO TO 211
      ANG=ATAN2(DANGY,DANGX)*57.2957795
C**** DEFAULT SIZE TO BE .15 IF NEGATIVE OR ZERO                    TIGP0195
  211 IF(STT(II).LE.0.)STT(II)=.15                                  TIGP0196
      ICH=KIN(STT(II)*.873)
      ICV=ICH*1.6                                                   TIGP0198
      IF(ITT(II).EC.1)GC TC 220                                          TIGP0199
      IX=IXTOS(XTT(II))                                                  TIGP0200
      IY=IYTCS(YTT(II))                                                  TIGP0201
      GO TC 230                                                          TIGP0202
  220 IX=XTT(II)                                                         TIGP0203
      IY=YTT(II)                                                         TIGP0204
  230 CALL PLCHAR(ICH,ICV)                                               TIGP0205
      IC=JTT(II)                                                         TIGP0206
      IA=KTT(II)                                                         TIGP0207
      CALL PTITE(IX,IY,8,ITC(1,II),IC,40,ANG,IPPX(1,II),IPPY(1,II))      TIGP0208
  240 CONTINUE                                                           TIGP0209
      CALL LINRCT(0.)                                                    TIGP0210
  250 NYM=IYDEN
      NXM=IXDEN
      CALL SHADEIT(IPPX,IPPY,NTITE)
      IF(IGRIDX.EC.0)GC TC 260                                           TIGP0211
      CALL PGRIDX(IPPX,IPPY,NTITE,NXM,NYM,1000,IGRIDX)
  260 IF(IGRIDY.EC.0)GO TO 270
      CALL PGRIDY(IPPX,IPPY,NTITE,NXM,NYM,1000,IGRIDY)
C                                                                        TIGP0217
C     MERGE HERE FCR INTERACTIVE FUNCTICNS (EELL)                        TIGP0218
C                                                                        TIGP0219
  270 CONTINUE                                                           TIGP0220
  280 CALL SWCHAR(0)
      CALL CHRSIZ(4)                                                     TIGP0221
      IKILL=0                                                            TIGP0222
      IF(LCNT.LT.220) GO TO 710                                          TIGP0223
      IF(NPTOT.EC.1) GO TO 320                                           TIGP0224
      CALL GETVAL(ICHAR,XO,YO)                                           TIGP0225
  290 IF(ICHAR.LE.64.OR.ICHAR.GE.95)GO TC 300                            TIGP0226
      ICHAR=ICHAR-64                                                     TIGP0227
      ICHECK=IQUICK(ICHAR)                                               TIGP0228
      IF(ICHECK.EC.0) GC TO 300                                          TIGP0229
      GO TO (390,500,540,280,590,640,720,740,770,570,800,790),ICHECK     TIGP0230
  300 LCNT=LCNT-LDEL                                                     TIGP0231
      CALL NOTATE(0,LCNT,10,MSG4)                                        TIGP0232
      GO TO 280                                                          TIGP0233
C                                                                        TIGP0234
C     ADD POINT AFTER OR BEFORE SPECIFIED POINT (A OR B)                 TIGP0235
C                                                                        TIGP0236
C     CHECK IF C CCMMAND  AND FIRST POINT.                               TIGP0237
C                                                                        TIGP0238
  310 IF(NPTOT.EC.0)GO TO 590                                            TIGP0239
  320 LCNT=LCNT-LDEL                                                     TIGP0240
      CALL NOTATE(0,LCNT,20,MSG1)                                        TIGP0241
  330 CALL GETVAL(ICHAR,XO,YO)                                           TIGP0242
C         CHECK FOR NEW LINE CCMMAND                                     TIGP0243
      IF(ICHAR.EC.86) GC TC 760                                          TIGP0244
C         CHECK FOR ADD AFTER                                            TIGP0245
  340 IF(ICHAR.EC.65) GO TO 350                                          TIGP0246
C         CHECK FCR MOVE                                                 TIGP0247
      IF(ICHAR.EC.77) GC TO 350                                          TIGP0248
C         IF NOT A B OR M GO TO NEW COMMAND                              TIGP0249
      IF(ICHAR.NE.66) GO TO 290                                          TIGP0250
  350 CALL POINTA(XO,YO)                                                 TIGP0251
      CALL MCVEA(XO,YO)                                                  TIGP0252
      IF(IOFF.EQ.0)CALL ANCHO(IS)                                        TIGP0253
      IF(ICHAR.EC.77) GC TC 370                                          TIGP0254
C*** CHECK FOR STCRAGE EXCEEDING 280 WARNING LIMIT                       TIGP0255
C         INCREMENT STORAGE COUNTER                                      TIGP0256
C     NPTOT=NPTCT+1                                                      TIGP0257
C         INCREMENT STORAGE CCUNTER                                      TIGP0258
```

```
C     NSTOR=NSTOR+1
C*** NEW LIST LINKED DATA SRORAGE
C*** NSTOR = LAST USED CELL
C*** NPTOT = NUMBER OF ACTUAL POINTS
      ISTOR=ISUB(KLAST)
      ISUB(KLAST)=ISUB(ISTOR)
      IF(JSAVE.EC.KLAST)KLAST=ISTOR
      NSTOR=NSTOR+1
      NPTOT=NPTOT+1
      NPTA(ISAVE)=NPTA(ISAVE)+1
C         MOVE POINTER OF CLOSEST POINT TO END
      ISUB(ISTOR)=ISUB(JSAVE)
C        CHANGE CLCSEST PCINTER TC ACCESS LAST PCINT
      ISUB(JSAVE)=ISTOR
      IF(ICHAR.EC.65) GC TC 360
C        MOVE OLD POINT TO LAST POINT ( INSERT BEFORE)
      X(ISTOR)=X(JSAVE)
      Y(ISTOR)=Y(JSAVE)
      GO TC 370
C        NEW POINT ADD AFTER
  360 JSAVE=ISTOR
  370 X(JSAVE)=X0
      Y(JSAVE)=Y0
      IF(NSTOR.LT.995) GC TO 330
      CALL NEWPAG
      CALL CHRSIZ(1)
      CALL ANMODE
      PRINT 380, NSTCR-NPTOT+5
  380 FORMAT(* WARNING DATA STORAGE IS NEARING 1000 MAX LIMIT*/
     1 * A REPACK PROCEDURE HAS BEEN INVOKED TC GIVE YOU*,I3,/
     2 * MORE STORAGE LOCATICNS....PRESS RETURN TO CONTINUE*
     3 ,/,* AND DELETE POINTS IF YOU CAN*)
      CALL TINPUT(I)
      CALL CHRSIZ(4)
      GO TO 500
C
C     DELETE POINT (D)
C
  390 DSAVE=1.E40
      IF(NPTOT.EQ.0) GC TO 280
      IS=64
      NSUM=1
      K=1
      DO 430 I=1,NL
      NEND=NSUM+NPTA(I)-1
C****
C****SAVE THE PCINT BEGINNING EACH LINE
      KBEGN=K
      DO 420 J=NSUM,NEND
      IF(IKILL.LE.0)GO TC 395
      IF(I.NE.IKILL)GO TC 410
  395 IF(NLINE.EQ.0) GO TO 400
      IF(NDRAW(I).EC.0) GO TC 410
  400 XDX=X(K)-X0
      YDY=Y(K)-Y0
      DIST=XDX*XDX*RDX2+YDY*YDY*RDY2
      IF(DIST.GE.DSAVE)GO TO 410
      DSAVE=DIST
      JSAVE=K
      ISAVE=I
      KLINE=KBEGN
  410 KBEFL=KLAST
```

```
      KLAST=K                                        TIGP0311
  420 K=ISUB(K)                                      TIGP0312
  430 NSUM=NEND+1                                    TIGP0313
      IS=ISAVE+64                                    TIGP0314
  440 IF(IS.LE.90)GO TO 450                          TIGP0315
      IS=IS-90                                       TIGP0316
      GO TO 440                                      TIGP0317
  450 CALL POINTA(X(JSAVE),Y(JSAVE))                 TIGP0318
      IF(IOFF.EQ.0)CALL ANCHO(IS)                    TIGP0319
      IF(ICHAR.EQ.11)GO TO 810                       TIGP0320
      IF(ICHAR.NE.4) GO TO 310                       TIGP0321
      K=JSAVE                                        TIGP0323
C**** NEW REVISION SPRING 82
      IF(K.NE.KLAST) GO TO 460
      KLAST=KBEFL
      GO TO 470
  460 KFWD=ISUB(K)
      IF(KFWD.NE.KLAST)GO TO 462
      KLAST=K
      GO TO 465
  462 ISUB(K)=ISUB(KFWD)
      ISUB(KFWD)=ISUB(KLAST)
      ISUB(KLAST)=KFWD
  465 X(K)=X(KFWD)
      Y(K)=Y(KFWD)
  470 NPTOT=NPTOT-1
      NSTOR=NSTOR-1
      NPTA(ISAVE)=NPTA(ISAVE)-1
      IF(NPTA(ISAVE).GT.0)GO TO 490                  TIGP0338
      NPTA(ISAVE)=0                                  TIGP0339
      J=0                                            TIGP0340
      DO 480 I=1,NL                                  TIGP0341
      IF(I.EQ.ISAVE)GO TO 480                        TIGP0342
      J=J+1                                          TIGP0343
      NPTA(J)=NPTA(I)                                TIGP0344
      VLABL(J)=VLABL(I)                              TIGP0345
      MTT(J)=MTT(I)                                  TIGP0346
      LTT(J)=LTT(I)                                  TIGP0347
  480 CONTINUE                                       TIGP0348
      NPTA(NL)=0                                     TIGP0349
      NL=NL-1                                        TIGP0350
      IKILL=0                                        TIGP0351
  490 IF(IKILL.EQ.0)GO TO 280                        TIGP0352
      IKILL=ISAVE                                    TIGP0353
      GO TO 810                                      TIGP0354
C                                                    TIGP0355
C     END (E)                                        TIGP0356
C                                                    TIGP0357
  500 CALL NEWPAG                                    TIGP0358
      L=1                                            TIGP0359
      DO 530 I=2,NPTOT                               TIGP0360
      K=ISUB(L)                                      TIGP0361
      IF(I.EQ.K) GO TO 530                           TIGP0362
      J=K                                            TIGP0363
      JLEFT=NPTOT+1-I                                TIGP0364
      DO 510 KK=1,JLEFT                              TIGP0365
      IF(J.EQ.I) GO TO 520                           TIGP0366
      JO=J                                           TIGP0367
  510 J=ISUB(JO)                                     TIGP0368
  520 ISUB(JO)=K                                     TIGP0369
      ISUB(L)=I                                      TIGP0370
      IS=ISUB(I)                                     TIGP0371
      ISUB(I)=ISUB(K)
      ISUB(K)=IS
      XS=X(I)
      X(I)=X(K)
      X(K)=XS
      XS=Y(I)
      Y(I)=Y(K)
      Y(K)=XS
  530 L=I
      IF(ICHECK.EQ.2) RETURN
      GO TO 30
C
C     FORMAT (F)
C
  540 LCNT=LCNT-LDEL
      CALL MOVABS(0,LCNT)
      CALL ANMODE
      IY=(YO-YEEG)/DELY+300
      II=(3045-IY)/50+1
      IF(II.LT.1) II=1
      IF(II.GT.NL) II=NL
      PRINT 550,LTT(II),MTT(II)
  550 FORMAT(* LT= *,I2,* MT= *,I2)
      CALL GETIN(2,VTEM)
      LTT(II)=VTEM(1)
      MTT(II)=VTEM(2)
      LCNT=LCNT-LDEL
C
C      IF F OUTSIDE OF AXIS THE SET ALL CURVE MODES
C
      IF(XO.LE.TXMIN) GO TO 280
      DO 560 I=1,50
      LTT(I)=VTEM(1)
  560 MTT(I)=VTEM(2)
      GO TO 280
C
C      CHANGE GRID OPTION
C
  570 LCNT=LCNT-LDEL
      CALL MOVABS(0,LCNT)
      CALL ANMODE
      PRINT *,
     1"GRID OPTIONS,(IN X,Y PAIRS)MAJOR,MINOR TICK MARKS , GRID SWTCHS"
      CALL GETIN(6,VTEM)
      LCNT=LCNT-LDEL
      IXDEN=VTEM(1)
      IYDEN=VTEM(2)
      ITMX=VTEM(3)
      ITMY=VTEM(4)
      IGRIDY=VTEM(5)
      IGRIDX=VTEM(6)
      GO TO 280
C
C     NEW LINE (N)
C
  590 NPTOT=NPTOT+1
      NSTOR=NSTOR+1
      IF(NPTOT.NE.1) GO TO 591
      ISTOR=1
      GO TO 592
  591 ISTOR=ISUB(KLAST)
  592 KLAST=ISTOR
```

```
      IF(IPLOT+ITAB.EQ.0)GO TO 760
  600 X(ISTOR)=XO
      Y(ISTOR)=YO
      NL=NL+1
      IS=NL+64
      ISAVE=NL
      JSAVE=ISTOR
C
C      NO DATA THEN DO[T SYMBOL IT
C
      IF(IPLOT.EQ.0) GO TO 630
  610 IF(IS.LE.90)GO TO 620
      IS=IS-90
      GO TO 610
  620 CALL POINTA(XO,YO)
      IF(IOFF.EQ.0)CALL ANCHO(IS)
  630 NPTA(NL)=1
      NL1=NL+1
      NPTA(NL1)=0
      LCNT=LCNT-LDEL
      CALL NOTATE(0,LCNT,22,MSG2)
      LCNT=LCNT-LDEL
      CALL MOVABS(0,LCNT)
      CALL ANMODE
      CALL GETIN(3,VTEM)
      VLABL(NL)=VTEM(1)
      LTT(NL)=VTEM(2)
      MTT(NL)=VTEM(3)
C*****ISAVE=NL
C*****JSAVE=NSTOR
      IF(IPLOT.EQ.0) GO TO 710
      GO TO 320
C
C     PLOT (P)
C
C
C      CHECK FOR TABLET MODE, SKIP SPECIAL P SECTION IF TABLET
C
  640 IF(ITAB.EQ.1) GO TO 710
      IF(XO.GT.TXMIN) GO TO 710
      IF(IDEN.GT.0)GO TO 680
      LCNT=3120
      CALL MOVABS(0,LCNT)
      CALL ANMODE
      PRINT 650,(LABVAL(J1),J1=1,NCC)
      CALL MOVABS(2800,2800)
  650 FORMAT(8A10)
      LCNT=LCNT-LDEL
      KL=0
      DO 670 J1=1,NL
      LCNT=LCNT-LDEL
      CALL MOVABS(0,LCNT)
      IF(KL.EQ.27)KL=0
      KL=KL+1
      CALL ANMODE
      PRINT 660,KL,VLABL(J1)
  660 FORMAT(1X, R1,G13.5)
  670 CONTINUE
      IDEN=1
C**** GET BACK TO PLOTTING LABEL ONLY TURNED ON
      GO TO 280
C****
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```
  680 IF(NLINE.GT.0) GO TO 700                                        TIGP0481
      DO 690 I=1,NL                                                   TIGP0482
  690 NDRAW(I)=0                                                      TIGP0483
  700 IY=(YO-YBEG)/DELY+300                                           TIGP0484
      II=(3045-IY)/50+1                                               TIGP0485
      IF(II.LT.1) II=1                                                TIGP0486
      IF(II.GT.NL) II=NL                                              TIGP0487
      NDRAW(II)=1                                                     TIGP0488
      NLINE=1                                                         TIGP0489
      GO TO 280                                                       TIGP0490
  710 CALL NEWPAG                                                     TIGP0491
      GO TO 50                                                        TIGP0492
C                                                                     TIGP0493
C     RESTORE WINDOW (R)                                              TIGP0494
C                                                                     TIGP0495
  720 IF(XO.GT.TXMIN.OR.NLINE.EQ.0) GO TO 730                         TIGP0496
      NLINE=0                                                         TIGP0497
      GO TO 280                                                       TIGP0498
  730 IWIN=0                                                          TIGP0499
      GO TO 710                                                       TIGP0500
C                                                                     TIGP0501
C     SHOW VALUE (S)                                                  TIGP0502
C                                                                     TIGP0503
  740 LCNT=LCNT-LDEL                                                  TIGP0504
      CALL MOVABS(0,LCNT)                                             TIGP0505
      CALL ANMODE                                                     TIGP0506
      PRINT 750,XO,YO                                                 TIGP0507
  750 FORMAT(*X=*,G13.5,/,*Y=*,G13.5)                                 TIGP0508
      LCNT=LCNT-LDEL                                                  TIGP0509
      GO TO 280                                                       TIGP0510
C                                                                     TIGP0511
C     VALUE IN (V)                                                    TIGP0512
C                                                                     TIGP0513
  760 LCNT=LCNT-LDEL                                                  TIGP0514
      CALL NOTATE(0,LCNT,10,MSG5)                                     TIGP0515
      LCNT=LCNT-LDEL                                                  TIGP0516
      CALL MOVABS(0,LCNT)                                             TIGP0517
      CALL ANMODE                                                     TIGP0518
      CALL GETIN(2,VTEM)                                              TIGP0519
      XO=VTEM(1)                                                      TIGP0520
      YO=VTEM(2)                                                      TIGP0521
C                                                                     TIGP0522
C     CHECK FOR N COMMAND VALUE INPUT SECTION.                        TIGP0523
C                                                                     TIGP0524
      IF(IPLOT.EQ.0) GO TO 600                                        TIGP0525
      LCNT=LCNT-LDEL                                                  TIGP0526
      CALL NOTATE(0,LCNT,13,MSG6)                                     TIGP0527
      CALL TINPUT(ICHAR)                                              TIGP0528
      GO TO 340                                                       TIGP0529
C                                                                     TIGP0530
C     WINDOW (W)                                                      TIGP0531
C                                                                     TIGP0532
  770 CALL GETVAL(ICHAT,X1,Y1)                                        TIGP0533
  780 AXMIN=AMIN1(XO,X1)                                              TIGP0534
      AXMAX=AMAX1(XO,X1)                                              TIGP0535
      AYMIN=AMIN1(YO,Y1)                                              TIGP0536
      AYMAX=AMAX1(YO,Y1)                                              TIGP0537
      IWIN=1                                                          TIGP0538
      IF(ICHAT.EQ.122) GO TO 710                                      TIGP0539
      IF((AYMAX-AYMIN)/DELY.GT.8.) GO TO 710                          TIGP0540
      LCNT=LCNT-LDEL                                                  TIGP0541
      CALL NOTATE(0,LCNT,29,MSG7)                                     TIGP0542
      LCNT=LCNT-LDEL*2                                                  TIGP0543
      CALL MOVABS(0,LCNT)                                               TIGP0544
      CALL ANMODE                                                       TIGP0545
      LCNT=LCNT-1                                                       TIGP0546
      CALL GETIN(4,VTEM)                                                TIGP0547
      X0=VTEM(1)                                                        TIGP0548
      Y0=VTEM(2)                                                        TIGP0549
      X1=VTEM(3)                                                        TIGP0550
      Y1=VTEM(4)                                                        TIGP0551
      DELY=1.E-99                                                       TIGP0552
      GO TO 780                                                         TIGP0553
C***** LOCATE TITLE                                                     TIGP0554
C*****                                                                  TIGP0555
C*790 CALL SWCHAR(1)                                                    TIGP0556
  790 CALL INTITE(X0,Y0)                                                TIGP0557
****  CALL SWCHAR(0)                                                    TIGP0558
      GO TO 280                                                         TIGP0559
C***** DELETE ENTIRE LINE CODE                                          TIGP0560
C*****                                                                  TIGP0561
  800 IKILL=-1                                                          TIGP0562
      GO TO 390                                                         TIGP0563
  810 X0=X(KLINE)                                                       TIGP0564
      Y0=Y(KLINE)                                                       TIGP0565
      ICHAR=4                                                           TIGP0566
      GO TO 390                                                         TIGP0567
      END                                                               TIGP0568
CDWIDE
      SUBROUTINE DWIDE(X,Y,IR)
      COMMON/TEKGPPR/LDEL,LCNT,MAXSR,LTV(17),EN(2),DELX,DELY
      DATA DS/8./
      IF(IR.EQ.-1)GO TO 200
      DX=(X-XB)/DELX
      DY=(Y-YB)/DELY
      ANG=1.5707963
      SL=1.E10
      IF(DX.EQ.0.) GO TO 120
      SL=DY/DX
      ANG=ATAN(SL)
  120 DXP=DS*SIN(ANG)
      DYP=DS*COS(ANG)
      IF(SL.NE.0.) DXP=-DXP
      IF((DX*DYP-DY*DXP).GE.0.)GO TO 190
      DXP=-DXP
      DYP=-DYP
  190 DXP=DXP*DELX
      DYP=DYP*DELY
      CALL DRAWA(XB+DXP,YB+DYP)
      CALL DRAWA(X+DXP,Y+DYP)
      CALL DRAWA(X,Y)
  200 XB=X
      YB=Y
      IR=0
      RETURN
      END
CGETVAL                                                                 GETV0001
      SUBROUTINE GETVAL(ICHAR,XV,YV)                                    GETV0002
      COMMON/TEKGPPR/DUM(3),ICL,ITAB,ITABS,XS,YS,DUM2(20),NLINE         GETV0003
C     ICL=0   INITIALIZE TABLET                                         GETV0004
C     IC=0    NOT IN CONTINUOUS MODE                                    GETV0005
C     ITAB=0  SCREEN CURSER                                             GETV0006
C****                                                                   GETV0007
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C**** GET VALUE AND CHARACTER FRCM CROSS HAIRS OR TABLET                GETV0008
C****                                                                   GETV0009
C****                                                                   GETV0010
C**** CHECK FOR TABLE INPUTS                                            GETV0011
C****                                                                   GETV0012
   10 IF(ITAB.EQ.1)GO TO 20                                             GETV0013
      CALL VCURSR(ICHAR,XV,YV)                                          GETV0014
C****                                                                   GETV0015
C**** CHECK TC SEE IF SCREEN COMMAND WAS TO ACTIVATE TABLET             GETV0016
C****                                                                   GETV0017
      IF(ICHAR.NE.84)GO TC 30                                           GETV0018
      ITAB=1                                                            GETV0019
      ICL=ITABS                                                         GETV0020
C****                                                                   GETV0021
C**** SET TABLET LAST CHARACTER (ALSO USED AS A FLAG FOR INITIALIZATION GETV0022
C****                                                                   GETV0023
   20 ICHAR=ICL                                                         GETV0024
      CALL TABVU(ICHAR,XV,YV)                                           GETV0025
C****                                                                   GETV0026
C**** SAVE LAST TABLET CHARACTER COMMAND                                GETV0027
C****                                                                   GETV0028
      ICL=ICHAR                                                         GETV0029
C*** IF IN TABLET MODE AND A NEW LINE COMMAND
C*** THEN TURN OFF COMMAND ...DEFAULT IT TO ADD AFTER
      IF(ICL.EQ.78)ICL=65
      NLINE=0                                                           GETV0030
C
C       SET FLAG TO PLOT ALL LINES IN TABLET MODE
C
C****                                                                   GETV0031
C**** CHECK FOR TABLET HALT COMMAND                                     GETV0032
C****                                                                   GETV0033
      IF(ICL.NE.72)GO TO 30                                             GETV0034
C****                                                                   GETV0035
C**** TURN OFF TABLET AND SAVE LAST COMMAND                             GETV0036
C****                                                                   GETV0037
      ITAB=0                                                            GETV0038
      ITABS=ICL                                                         GETV0039
      RETURN                                                            GETV0040
   30 IF(ICHAR.EQ.69)ITABS=0                                            GETV0041
      RETURN                                                            GETV0042
      END                                                               GETV0043
CTAEVU
                                                                TAEV0001
      SUBROUTINE TAEVU(ICHAR,XV,YV)                                     TABV0002
      COMMON/TEKGPPR/LDEL,LCNT,MAXSR,LTV(5)                             TABV0003
     1 ,LS,MX1,MY1,MX2,MY2,XB,YB,FACX,FACY,ANG,MXB,MYB                  TABV0004
      DIMENSION MSG1(54),MSG2(43),MSG3(43),MSG4(18),ICONV(2,10),        TABV0005
     1          IRETN(2,10),XTEM(2)                                     TABV0006
      DATA ((ICONV(I,J),J=1,10),I=1,2)/65,66,67,68,69,71,72,            TABV0007
     1                                105,78,80,82,83,86,87,            TABV0008
     1                                 32 ,32 ,32,32,32,32/             TABV0009
      DATA ((IRETN(I,J),J=1,10),I=1,2)/ 0, 0, 0, 0, 1, 1, 1,            TABV0010
     1                                  1, 0, 1, 1, 0, 1, 0,            TABV0011
     1                                  1, 1, 1, 1, 1, 1/               TABV0012
      DATA MSG1/ 83,113,117, 97,114,101, 32,109,101,110,                TABV0013
     1          117, 32,119,105,116,104, 32,116, 97, 98,                TABV0014
     1          108,101,116, 32, 97,110,100, 32,116,111,                TABV0015
     1          117, 99,104, 32,117,112,112,101,114, 32,                TABV0016
     1          108,101,102,116, 32,109,101,110,117, 32,                TABV0017
     1          100,111,116, 46/                                        TAEV0018
      DATA MSG2/ 84,111,117, 99,104, 32, 97,120,105,115,                TABV0019
     1         32,111,114,105,103,105,110, 32, 97,110,                  TABV0020
     1        100, 32,101,110,116,101,114, 32,118, 97,                  TABV0021
     1        108,117,101,115, 32, 88, 32, 97,110,100,                  TABV0022
     1         32, 89, 46/                                              TABV0023
      DATA MSG3/ 84,111,117, 99,104, 32, 32, 32, 97,120,                TABV0024
     1        105,115, 32, 97,116, 32,109, 97,120, 32,                  TABV0025
     1        108,101,110,103,116,104, 32, 97,110,100,                  TABV0026
     1         32,101,110,116,101,114, 32,118, 97,108,                  TABV0027
     1        117,101, 46/                                              TABV0028
      DATA MSG4/ 76, 97,115,116, 32, 99,111,109,109, 97,                TABV0029
     1        110,100, 32,119, 97,115, 32, 32/                          TABV0030
      IF(ICHAR.NE.0)GO TO 30                                            TABV0031
C         TABLET HAS NOT BEEN SET CHECK IT                              TABV0032
      LS=100                                                            TABV0033
      CALL TABINT(1,0,0)                                                TABV0034
      CALL NEWPAG                                                       TABV0035
      LCNT=3120-LDEL                                                    TABV0036
C         GET MENU POSITION                                             TABV0037
      CALL NOTATE(0,LCNT,54,MSG1)                                       TABV0038
      CALL BELL                                                         TABV0039
      CALL ONEPNT(MX1,MY1)                                              TABV0040
      MX2=MX1+1000                                                      TABV0041
      MY2=MY1-200                                                       TABV0042
      GO TO 20                                                          TABV0043
   10 LCNT=3120                                                         TABV0044
      CALL NEWPAG                                                       TABV0045
   20 LCNT=LCNT-LDEL                                                    TABV0046
C         GET COORDINATE INTERSECTION                                   TABV0047
      CALL NOTATE(0,LCNT,43,MSG2)                                       TABV0048
      CALL BELL                                                         TABV0049
      CALL ONEPNT(MXB,MYB)                                              TABV0050
      LCNT=LCNT-LDEL                                                    TABV0051
      CALL MOVABS(0,LCNT)                                               TABV0052
      CALL ANMODE                                                       TABV0053
      CALL GETIN(2,XTEM)                                                TABV0054
      XB=XTEM(1)                                                        TABV0055
      YB=XTEM(2)                                                        TABV0056
      LCNT=LCNT-LDEL                                                    TABV0057
      MSG3(7)=88                                                        TABV0058
C        GET X AXIS POSITION MAX                                        TABV0059
      CALL NOTATE(0,LCNT,43,MSG3)                                       TABV0060
      CALL BELL                                                         TABV0061
      CALL ONEPNT(MXM,NXM)                                              TABV0062
      LCNT=LCNT-LDEL                                                    TABV0063
      CALL MOVABS(0,LCNT)                                               TABV0064
      CALL ANMODE                                                       TABV0065
C        GET VALUE AT POSITION                                          TABV0066
      CALL GETIN(1,XM)                                                  TABV0067
      DX=MXM-MXB                                                        TABV0068
      DY=NXM-MYB                                                        TABV0069
C        COMPUTE ANGLE CORRECTION                                       TABV0070
      ANG=ATAN2(DY,DX)                                                  TABV0071
      LCNT=LCNT-LDEL                                                    TABV0072
      MSG3(7)=89                                                        TABV0073
C        GET Y AXIS POSITION MAX                                        TABV0074
      CALL NOTATE(0,LCNT,43,MSG3)                                       TABV0075
      CALL BELL                                                         TABV0076
      CALL ONEPNT(MYM,NYM)                                              TABV0077
      LCNT=LCNT-LDEL                                                    TABV0078
      CALL MOVABS(0,LCNT)                                               TABV0079
      CALL ANMODE                                                       TABV0080
C        GET VALUE AT POSITION                                          TABV0081
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```
      CALL GETIN(1,YM)                                                  TABV0082
      DY=NYM-MYB                                                        TABV0083
      COSA=COS(ANG)                                                     TABV0084
C        SET UP COMMON FACTORS FOR ANGLE CORRECTIONS                    TABV0085
      FACX=(XM-XB)*COSA/DX                                              TABV0086
      FACY=(YM-YB)*COSA/DY                                              TABV0087
      INIT=1                                                            TABV0088
      XV=XM                                                             TABV0089
      YV=YM                                                             TABV0090
      ICHAR=87                                                          TABV0091
C        RETURN PLOT COMMAND                                            TABV0092
      RETURN                                                            TABV0093
C        CHECK FOR TABLET INITALIZED                                    TABV0094
   30 IF(INIT.NE.1)GO TO 40                                             TABV0095
      ICHAR=122                                                         TABV0096
      XV=XB                                                             TABV0097
      YV=YB                                                             TABV0098
      INIT=0                                                            TABV0099
      RETURN                                                            TABV0100
   40 CALL BELL                                                         TABV0101
      CALL ONEPNT(IX,IY)                                                TABV0102
C        CHECK TO SEE IF POINT SENT IS A MENU COMMAND                   TABV0103
      IF(IX.GT.MX2.OR.IX.LT.MX1)GO TO 50                                TABV0104
      IF(IY.GT.MY1.OR.IY.LT.MY2)GO TO 50                                TABV0105
      IC=(IX-MX1)/LS+1                                                  TABV0106
      IR=(MY1-IY)/LS+1                                                  TABV0107
C        CONVERT ROW AND COLUMN POSITION TO COMMAND CHARACTER            TABV0108
      ICHAR=ICONV(IR,IC)                                                TABV0109
      IF(ICHAR.EQ.32) RETURN                                            TABV0110
      MSG4(18)=ICHAR                                                    TABV0111
      LCNT=LCNT-LDEL                                                    TABV0112
C        LAST MESSAGE COMMAND                                           TABV0113
      CALL NOTATE(0,LCNT,18,MSG4)                                       TABV0114
      IF(ICHAR.EQ.105)GO TO 10                                          TABV0115
      IF(IRETN(IR,IC).EQ.1)RETURN                                       TABV0116
      GO TO 40                                                          TABV0117
C        CONVERT TABLET UNITS TO VIRTUAL UNITS WITH ANGLE CORRECTION     TABV0118
   50 DX=IX-MXB                                                         TABV0119
      DY=IY-MYB                                                         TABV0120
      IF(DX.EQ.0.)DX=1.E-20                                             TABV0121
      R=SQRT(DX*DX+DY*DY)                                               TABV0122
      ANGR=ATAN2(DY,DX)-ANG                                             TABV0123
      XV=R*FACX*COS(ANGR)+XB                                            TABV0124
      YV=R*FACY*SIN(ANGR)+YB                                            TABV0125
      RETURN                                                            TABV0126
      END                                                               TABV0127
CDRAWIT                                                                 DRAW0001
      SUBROUTINE DRAWIT(NL,NPTA,X,Y,ISUB,MTT,LTT)
      COMMON /SHAD/KSHADE(2,168)
      COMMON/TKTRNX/ITEKC(60)                                           DRAW0003
      COMMON/TEKGPPR/DUM(20),EN(2),DEL(2),BEG(2),RDX2,RDY2,NLINE,       DRAW0004
     1 NDRAW(50)
      EQUIVALENCE (IOFF,ITEKC(30))                                      DRAW0007
      DIMENSION QSY(626),QSX(626),NPTA(1),X(1),Y(1),ISUB(1)             DRAW0006
      DIMENSION MCON(16),IDLN(10),MTT(1),LTT(1)
      DATA MCON/2,1,2,3,4,5,0,0,0,0,0,-1,-2,-3,-4,-5/
      DATA IDLN/
     +0,56,
     +776,
     +77616,
     +7777777616,
     +77761616161,
     +777777776,
     +777777616161,
     +776655443322,
     +18/
C
C                                                                       DRAW0009
C 0 SYMBOLS  1 LINE  2 SPLINE WRT X  3 SPLINE WRT Y  4 ARC FIT 5 CLOSED DRAW0010
C                                                                       DRAW0012
      DO 1 I=1,166
      KSHADE(2,I)=0
    1 KSHADE(1,I)=0
      IT=64                                                             DRAW0013
      K=1                                                               DRAW0014
      NSUM=1                                                            DRAW0015
      NC=0
      DO 290 I=1,NL                                                     DRAW0016
      IR=-1
      KIND=LTT(I)+1
      LDASH=IDLN(KIND)
      KIND=MTT(I)+1
      IWID=0
    2 IF(KIND.LT.20)GO TO 5
      IWID=IWID+1
      KIND=KIND-10
      GO TO 2
    5 ISYM=MCON(KIND)
      ITYP=IABS(ISYM)
      IF(ITYP.GT.1) GO TO 40                                            DRAW0008
      NEND=NSUM+NPTA(I)-1                                               DRAW0017
      IT=IT+1                                                           DRAW0018
      IF(IT.GT.90)IT=65                                                 DRAW0019
      DO 20 J=NSUM,NEND                                                 DRAW0020
      IF(NLINE.EQ.0) GO TO 10                                           DRAW0021
      IF(NDRAW(I).EQ.0) GO TO 20                                        DRAW0022
   10 XP=X(K)                                                           DRAW0023
      YP=Y(K)                                                           DRAW0024
      IF(J.EQ.NSUM) CALL MOVEA(XP,YP)                                   DRAW0025
      IF(LDASH.EQ.0)GO TO 16
      CALL DASHA(XP,YP,LDASH)
      GO TO 15
   16 IF(IWID.NE.2)GO TO 17
      CALL SHADE(XP,YP,IR)
      GO TO 15
   17 CALL DRAWA(XP,YP)
      IF(IWID.EQ.1)CALL DWIDE(XP,YP,IR)
   15 IF(ISYM.LT.0) GO TO 20                                            DRAW0027
      CALL MOVEA(XP,YP)                                                 DRAW0028
      IF(IOFF.EQ.0) CALL ANCHO(IT)                                      DRAW0029
      CALL MOVEA(XP,YP)                                                 DRAW00
   20 K=ISUB(K)                                                         DRAW0030
   30 NSUM=NEND+1                                                       DRAW0031
      GO TO 290                                                         DRAW0033
C                                                                       DRAW0034
C     PLOT WITH SPLINE                                                  DRAW0035
C                                                                       DRAW0036
   40 NS=NC                                                             DRAW0042
      NPT=NPTA(I)                                                       DRAW0043
      NC=NC+NPT                                                         DRAW0044
      IT=IT+1                                                           DRAW0045
      IF(IT.GT.90)IT=65                                                 DRAW0046
      IF(NLINE.EQ.0) GO TO 60                                           DRAW0047
      IF(NDRAW(I).NE.0) GO TO 60                                        DRAW0048
```

```
C        LOCATE POINTER OT NEXT LINE
      DO 50 L=1,NPT
   50 K=ISUB(K)
      GO TO 290
   60 JFIT=2
      YO=Y(K)
      K1=ISUB(K)
      IF(ITYP.GT.2) GO TO 80
      XO=X(K)
C        CHECK X DATA FOR ASCENDING ORDER
      DO 70 L=2,NPT
      X1=X(K1)
      IF(X1.LE.XO) GO TO 110
      K1=ISUB(K1)
   70 XO=X1
      GO TO 210
   80 IF(ITYP.GT.3) GO TO 100
C         CHECK Y DATA FOR ASCENDING ORDER
      DO 90 L=2,NPT
      Y1=Y(K1)
      IF(Y1.LE.YO) GO TO 110
      K1=ISUB(K1)
   90 YO=Y1
      GO TO 210
  100 JFIT=ITYP-2
  110 NCIR=0
      IF(JFIT.EQ.3) NCIR=-NPT/2-1
      IF(NCIR.LT.-5) NCIR=-5
      MPT=NPT-2*NCIR
      QSY(1)=MPT
      QSX(1)=MPT
      S=0.
      KA=NS
      KO=KA
      KE=KO+NPT
      KSAVE=K
      KA=KA+NCIR
      DO 160  M=1,MPT
      M1=M+1
      KA=KA+1
      IF(KA.GT.KO) GO TO 130
      NDO=NPT+NCIR
      DO 120 II=1,NDO
  120 K=ISUB(K)
      KA=KA+NPT
      GO TO 140
  130 IF(KA.NE.(KE+1))GO TO 140
      JSAVE=K
      K=KSAVE
      KA=KA-NPT
  140 CONTINUE
      L=M1+MPT
      YYYP=Y(K)
      XXXP=X(K)
      K=ISUB(K)
      IF(M.EQ.1) GO TO 150
      DS=SQRT(RDX2*(XXXP-XO)**2+RDY2*(YYYP-YO)**2)
      S=S+DS
  150 XO=XXXP
      YO=YYYP
      QSX(M1)=S
      QSY(M1)=S
      QSX(L)=XXXP
```

```
160 CSY(L)=YYYP                                                   DRAW0111
    KA=KO+NPT                                                     DRAW0112
    QSX(L+1)=0.                                                   DRAW0113
    CSY(L+1)=0.                                                   DRAW0114
    CSY(L+2)=1.                                                   DRAW0115
    CSY(L+2)=1.                                                   DRAW0116
    XO=QSX(MPT+2-NCIR)                                            DRAW0117
    YO=QSY(MPT+2-NCIR)                                            DRAW0118
    IF(ISYM.LE.0) GO TO 169
    CALL MOVEA(XO,YO)                                             DRAW0119
    IF(IOFF.EQ.0) CALL ANCHO(IT)                                  DRAW0120
169 CALL MOVEA(XO,YO)                                             DRAW0121
    IF(IWID.EQ.1)CALL DWIDE(XO,YO,IR)
    IF(IWID.EQ.2)CALL SHADE(XO,YO,IR)
    SCK=QSX(3-NCIR)                                               DRAW0122
    S=QSX(2-NCIR)                                                 DRAW0123
    IF(NPT.LE.1) GO TO 290                                        DRAW0124
    DC=40.                                                        DRAW0125
    DS=40.                                                        DRAW0126
    NCK=2                                                         DRAW0127
170 S=S+DS                                                        DRAW0128
    XP=SPLNQ1(1,QSX,S)                                            DRAW0129
    YP=SPLNQ1(1,QSY,S)                                            DRAW0130
    DCK=SQRT(RDX2*(XO-XP)**2+RDY2*(YO-YP)**2)                     DRAW0131
    DS= DC*DS/DCK                                                 DRAW0132
180 IF(S.LT.SCK) GO TO 200                                        DRAW0133
    NSYM=MPT+1+NCK-NCIR                                           DRAW0134
    XS=QSX(NSYM)                                                  DRAW0135
    YS=QSY(NSYM)                                                  DRAW0136
    IF(LDASH.EQ.0)GO TO 185
    CALL DASHA(XP,YP,LDASH)
    GO TO 186
185 IF(IWID.NE.2)GO TO 187
    CALL SHADE(XS,YS,IR)
    GO TO 18(
187 CALL DRAWA(XS,YS)                                             DRAW0137
    IF(IWID.EQ.1)CALL DWIDE(XS,YS,IR)
186 IF(ISYM.LE.0)GO TO 190
    CALL MOVEA(XS,YS)                                             DRAW0139
    IF(IOFF.EQ.0) CALL ANCHO(IT)                                  DRAW0140
    CALL MOVEA(XS,YS)                                             DRAW0141
190 NCK=NCK+1                                                     DRAW0142
    SCK=QSX(NCK+1-NCIR)                                           DRAW0143
    IF(NCK.LE.NPT+JFIT-2) GO TO 180                               DRAW0144
    IF(JFIT.EQ.3) K=JSAVE                                         DRAW0145
    GO TO 290                                                     DRAW0146
200 IF(LDASH.EQ.0)GO TO 205
    CALL DASHA(XP,YP,LDASH)
    GO TO 206
205 IF(IWID.NE.2) GO TO 207
    CALL SHADE(XP,YP,IR)
    GO TO 206
207 CALL DRAWA(XP,YP)
    IF(IWID.EQ.1)CALL DWIDE(XP,YP,IR)
206 XO=XP                                                         DRAW0148
    YO=YP                                                         DRAW0149
    GO TO 170                                                     DRAW0150
210 QSX(1)=NPT                                                    DRAW0151
    DO 240 M=1,NPT                                                DRAW0152
    N=M+1                                                         DRAW0153
    KA=NS+M                                                       DRAW0154
    L=N+NPT                                                       DRAW0155
    XP=X(K)                                                       DRAW0156
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      YP=Y(K)                                                           DRAW0157
      IF(ISYM.LE.0) GO TO 220
      CALL MOVEA(XP,YP)                                                 DRAW0159
      IF(ICFF.EQ.0) CALL ANCHO(IT)                                      DRAW0160
  220 IF(ITYP.NE.3) GO TO 230                                           DRAW0161
      QSX(N)=YP                                                         DRAW0162
      QSX(L)=XP                                                         DRAW0163
      GO TO 240                                                         DRAW0164
  230 QSX(N)=XP                                                         DRAW0165
      QSX(L)=YP                                                         DRAW0166
  240 K=ISUB(K)                                                         DRAW0167
      QSX(L+1)=0.                                                       DRAW0168
      QSX(L+2)=1.                                                       DRAW0169
      XEN=QSX(NPT+1)                                                    DRAW0170
      XIN=QSX(2)                                                        DRAW0171
      IFITP=ITYP-1                                                      DRAW0172
      BCK=BEG(IFITP)                                                    DRAW0173
      ECK=EN(IFITP)                                                     DRAW0174
      DELT=DEL(IFITP)*30.                                               DRAW0175
      IF(XIN.LT.BCK) XIN=BCK                                            DRAW0176
      IF(XEN.GT.ECK) XEN=ECK                                            DRAW0177
      KILL=0                                                            DRAW0178
      DO 280 M=1,200                                                    DRAW0179
      XI=XIN+DELT*(M-1)                                                 DRAW0180
      IF(XI.LT.XEN) GO TO 250                                           DRAW0181
      KILL=1                                                            DRAW0182
      XI=XEN                                                            DRAW0183
  250 YI=SPLNC1(1,QSX,XI)                                               DRAW0184
      IF(ITYP.EQ.3) GO TO 260                                           DRAW0185
      XP=XI                                                             DRAW0186
      YP=YI                                                             DRAW0187
      GO TO 270                                                         DRAW0188
  260 XP=YI                                                             DRAW0189
      YP=XI                                                             DRAW0190
  270 IF(M.EQ.1) CALL MOVEA(XP,YP)                                      DRAW0191
      IF(LDASH.EQ.0)GO TO 275
      CALL DASHA(XP,YP,LDASH)
      GO TO 276
  275 IF(IWID.NE.2) GO TO 277
      CALL SHADE(XP,YP,IR)
      GO TO 276
  277 CALL DRAWA(XP,YP)
      IF(IWID.EQ.1)CALL DWIDE(XP,YP,IR)
  276 IF(NPT.EQ.1) GO TO 290
      IF(KILL.EQ.1) GO TO 290                                           DRAW0194
  280 CONTINUE                                                          DRAW0195
  290 CONTINUE                                                          DRAW0196
  300 RETURN                                                            DRAW0197
      END                                                               DRAW0198
CSHADE
      SUBROUTINE SHADE(XO,YO,IR)
      COMMON/TEKGPPR/LDEL,LCNT,MAXSR,LTV(17),EN(2),DEL(2),BEG(2)
      COMMON /SHAD/KSHADE(2,168)
      IXTOS(X)=((X-BEG(1))/DEL(1)+600)                                   TIGP00
      IYTOS(Y)=((Y-BEG(2))/DEL(2)+300)                                   TIGP00
      X=XO
      Y=YO
      IF(IR.EQ.-1) GO TO 200
      IF(XB.LT.X) GO TO 10
      X2=XB
      Y2=YP
      XB=X
      YB=Y
      GO TO 15
   10 X2=X
      Y2=Y
   15 IX1=IXTOS(XB)
      IY1=IYTOS(YB)
      IX2=IXTOS(X2)
      IY2=IYTOS(Y2)
      IF(IX2.EQ.IX1)GO TO 200
      SL=FLOAT(IY2-IY1)/FLOAT(IX2-IX1)
      B=IY1-SL*IX1
      ISX=FLOAT(IX1-600)/20.
   20 ISX=ISX+1
      IF(ISX.LT.1)ISX=1
      IX=ISX*20+600
      IF(IX.GT.IX2) GO TO 200
      IF(ISX.GT.168)GO TO 200
      IY=(SL*IX+B)
      ISY=(IY-300)/20
      IF(ISY.LE.0)GO TO 20
      IF(ISY.GT.120)ISY=120
      DO 50 I=1,ISY
      IW=I/61 +1
      IWS=KSHADE(IW,ISX)
      IP=SHIFT(1,(60*IW-I+1))
      IF((IP.AND.IWS).EQ.0)GO TO 45
      IWS=IWS.AND.(77777777777777777777B-IP)
      GO TO 50
   45 IWS=IWS.OR.IP
   50 KSHADE(IW,ISX)=IWS
      GO TO 20
  200 IR=0
      XB=XO
      YB=YO
      RETURN
      END
CSHADEIT
      SUBROUTINE SHADEIT(ITX,ITY,NTIT)
      COMMON /SHAD/KSHADE(2,168)
      DIMENSION ITX(4,50),ITY(4,50),IPP(100),ITN(100),IDN(20)
      IPEND=2700
      DEL=20.
      IDX=20
      NMAX=168
      DO 1000 N=1,NMAX
      IF(KSHADE(1,N).NE.0)GO TO 10
      IF(KSHADE(2,N).NE.0)GO TO 10
      IF((1.AND.KSHADE(1,N)).NE.0) GO TO 10
      IF((1.AND.KSHADE(2,N)).NE.0) GO TO 10
      GO TO 1000
   10 IPX=600.+DEL*N
      K=0
      DO 101 L=1,NTIT
      J=4
      DO 100 I=1,4
      IX1=ITX(J,L)
      IX2=ITX(I,L)
      IY1=ITY(J,L)
      IY2=ITY(I,L)
      IMINX=MIN0(IX1,IX2)
      IF(IPX.LE.IMINX) GO TO 100
      IMAXX=MAX0(IX1,IX2)
      IF(IPX.GT.IMAXX)GO TO 100
      IF(IY1.EQ.IY2)GO TO 50
      S=(IX2-IX1)/FLOAT(IY2-IY1)
      B=FLOAT(IX1)-S*IY1
      IY1=IFIX((FLOAT(IPX)-B)/S)
   50 LL=L
      IF(IY1.GT.IPEND)GO TO 100
      IF(K.EQ.0)GO TO 95
      DO 90 M1=1,K
      IF(IY1.GT.IPP(M1))GO TO 90
      IPS1=IPP(M1)
      IPP(M1)=IY1
      IY1=IPS1
      IPS1=ITN(M1)
      ITN(M1)=LL
      LL=IPS1
   90 CONTINUE
   95 K=K+1
      ITN(K)=LL
      IPP(K)=IY1
  100 J=I
  101 CONTINUE
      NC=0
      K=K+1
      IPP(K)=IPEND
      ITN(K)=0
      IPO=300
      ISUB=0
      DO 200 I=1,K
      L=ITN(I)
      IPY=IPP(I)
      IF(NC.EQ.0)GO TO 160
      DO 120 J=1,NC
      IF(IDN(J).EQ.L) GO TO 130
  120 CONTINUE
      NC=NC+1
      IF(NC.GT.10)STOP "ERROR IN NC SHADEIT"
      IDN(NC)=L
      GO TO 140
  130 IDN(J)=IDN(NC)
      NC=NC-1
  140 IDX=(IPY/20)*20+20-IPY
      IPO=IPY
      GO TO 200
  160 IF(IPY.LT.IPO) GO TO 200
  165 IF(IPY.LT.(IPO+IDX)) GO TO 180
      IPO=IPO+IDX
      IDX=20
      ISUB=FLOAT(IPO-300)/20.
      IW=1
      IF(ISUB.GT.60)IW=2
      IWS=KSHADE(IW,N)
      ICP=SHIFT(1,(60*IW-ISUB+1))
      IF((ICP.AND.IWS).EQ.0)GO TO 165
      CALL PNTABS(IPX,IPO)
      GO TO 165
  180 CONTINUE
      IPO=IPY
      NC=NC+1
      IDN(NC)=L
  200 CONTINUE
 1000 CONTINUE
      END
```

```
CSPLNC1
      FUNCTION  SPLNQ1    (NLOC,X,XINDEP)
      COMMON/SPLCO/DX,QM
C*** LOCAL CUBIC FIT   8/9/77  M.J. CADDY
      DIMENSION X(1),CM(3)
      EQUIVALENCE (QM(1),T3),(CM(2),Q2),(QM(3),C3)
      XIN=XINDEP
      NS=NLOC
      NOPTS=X(NS)
      ID=NS+NOPTS
      NSP1=NS+1
      NSP2=NS+2
      IF(NOPTS.LE.1) GO TC 130
      IF(NOPTS.GT.2) GC TO 10
      N=ID+NOPTS
      T3=(X(N)-X(N-1))/(X(ID)-X(ID-1))
      M=ID
      NTRAP=1
      GO TO 280
   10 NS2=NOPTS*2+NSP1
      L=X(NS2)
      LSC=NS2+1
      IQMODE=X(LSC)
      K=L+NS
      NL=NSP1
      NH=ID
      NTRAP=-1
C*** BINARY SEARCH FOR INTERVAL
      IF(XIN-X(ID))30,140,20
   20 NTRAP=0
      GO TO 150
   30 IF(XIN-X(NSP1))40,40,60
   40 NTRAP=1
   50 K=NSP2
      GO TO 160
   60 IF(L)120,120,70
   70 IF(XIN-X(K))80,100,100
   80 NH=K
      K=K-1
   90 IF(XIN-X(K))110,100,100
  100 NL=K
      GO TO 120
  110 NH=K
  120 K=(NH-NL)/2+NL
      IF(K-NL)90,140,90
  130 YOUT=X(NSP2)
      GO TO 320
  140 LFAST=L-NH+NS
      X(NS2)=NH-NS
  150 K=NH
  160 M=K
      N=M+NOPTS
      Y3=X(N-1)
      X3=X(M-1)
C*** CHECK FOR FAST MODE AND  EXTRAPOLATION
      IF(NTRAP.GE.0) GO TC 180
      IF(IQMODE*L.EQ.0.OR.LFAST.NE.0) GO TC 180
      DO 170 I=1,3
  170 QM(I)=X(LSC+I)
      GO TC 310
  180 Y4=X(N)
      X4=X(M)
      A3=X4-X3                                                          SPLN0061
      S3=(Y4-Y3)/A3                                                     SPLN0062
      IF(M.EQ.NSP2) GO TO 190                                           SPLN0063
      X2=X(M-2)                                                         SPLN0064
      Y2=X(N-2)                                                         SPLN0065
      S2=(Y3-Y2)/(X3-X2)                                                SPLN0066
      IF(M.EQ.ID) GO TO 200                                             SPLN0067
  190 X5=X(M+1)                                                         SPLN0068
      Y5=X(N+1)                                                         SPLN0069
      S4=(Y5-Y4)/(X5-X4)                                                SPLN0070
      IF(M.EQ.NSP2)   S2=S3+S3-S4                                       SPLN0071
      GO TO 210                                                         SPLN0072
  200 S4=S3+S3-S2                                                       SPLN0073
  210 IF(M.LE.(NSP2+1))    GO TO 220                                    SPLN0074
      S1=(Y2-X(N-3))/(X2-X(M-3))                                        SPLN0075
      GO TO 230                                                         SPLN0076
  220 S1=S2+S2-S3                                                       SPLN0077
  230 IF(M.GE.(ID-1))    GO TO 240                                      SPLN0078
      S5=(X(N+2)-Y5)/(X(M+2)-X5)                                        SPLN0079
      GO TO 250                                                         SPLN0080
  240 S5=S4+S4-S3                                                       SPLN0081
  250 W2=ABS(S4-S3)                                                     SPLN0082
      W3=ABS(S2-S1)                                                     SPLN0083
      SW=W2+W3                                                          SPLN0084
      IF(SW.NE.0.0)     GO TO 260                                       SPLN0085
      W2=0.5                                                            SPLN0086
      W3=0.5                                                            SPLN0087
      SW=1.0                                                            SPLN0088
  260 T3=(W2*S2+W3*S3)/SW                                               SPLN0089
      W3=ABS(S5-S4)                                                     SPLN0090
      W4=ABS(S3-S2)                                                     SPLN0091
      SW=W3+W4                                                          SPLN0092
      IF(SW.NE.0.0)    GO TO 270                                        SPLN0093
      W3=0.5                                                            SPLN0094
      W4=0.5                                                            SPLN0095
      SW=1.0                                                            SPLN0096
  270 T4=(W3*S3+W4*S4)/SW                                               SPLN0097
      IF(NTRAP.LT.0) GO TO 290                                          SPLN0098
      IF(NTRAP.EQ.0) T3=T4                                              SPLN0099
  280 IX=M-NTRAP                                                        SPLN0100
C*** FAST EXIT FOR 2 POINTS AND LINEAR EXTRAPOLATION                     SPLN0101
      YOUT=X(IX+NOPTS)+(XIN-X(IX))*T3                                   SPLN0102
      GO TO 320                                                         SPLN0103
  290 Q2=(2.0*(S3-T3)+S3-T4)/A3                                         SPLN0104
      Q3=(-S3-S3+T3+T4)/(A3*A3)                                         SPLN0105
      IF(IQMODE*LFAST.EQ.0) GO TO 310                                   SPLN0106
      DO 300 I=1,3                                                      SPLN0107
  300 X(LSC+I)=QM(I)                                                    SPLN0108
  310 DX=XIN-X3                                                         SPLN0109
      YOUT=Y3+DX*(T3+DX*(Q2+DX*Q3))                                     SPLN0110
  320 SPLNQ1=YOUT                                                       SPLN0111
      RETURN                                                            SPLN0112
      END                                                               SPLN0113
CPTITE
      SUBROUTINE PTITE(IXI,IYI,NTL,LABTL,IC,NM,AT,IPX,IPY)
      DIMENSION LABTL(1),IP(136),IPX(4),IPY(4)
C         NTL =NUMBER OF 10 CHARACTER WORDS
C         NM MAX CHARACTERS PER LINE
C         AT ANGLE OF TITLE
C         IX SCREEN CENTER
C         IY SCREEN CENTER
```

```
C        IC =1 NOT CENTERED TITLE
      IF(NTL.LE.0) RETURN
      NC=10*NTL
      CO=1.
      SI=0.
C        GET CHARACTER SIZE
      CALL CSIZE(IHORZ,IVERT)
C        CONVERT LABEL TO ADE
      NR=NC
      IF(NC.GT.70)NR=70
      CALL KAM2AS(NR,LABTL,IP)
      IF(NR.EC.NC)GO TO 5
      NR=NC-70
      CALL KAM2AS(NR,LABTL(8),IP(71))
    5 IX=IXI
      IY=IYI
      IX1=IX
      IY1=IY
      ITL1=0
      NCM=0
      NL=0
      NBLK=0
      CALL LINROT(AT)
      ANG=AT*.01745329252
      CO=COS(ANG)
      SI=SIN(ANG)
      DO 70 K=1,NC
C        CHECK FOR LEADING BLANKS
      IF(IP(K).NE.32) GO TC 10
      IF(ITL1.EQ.0) GO TO 70
      NBLK=NBLK+1
C        CHECK FOR 3 BLANKS TC TERMINATE LINE
      IF(NBLK.NE.3) GO TC 20
      ITL1=ITL1-2
      GO TO 50
   10 NBLK=0
C        CHECK FOR MAX LINE LENGTH EXCEEDED
   20 IF(ITL1.LT.NM) GC TO 30
      IF(IP(K).EQ.32) GO TO 50
   30 ITL1=ITL1+1
      IP(ITL1)=IP(K)
      IF(K.LT.NC) GO TC 70
   40 ITL1=ITL1-NBLK
C        CHECK FOR VERTICAL OR HORIZ LABEL
   50 IF(ITL1.GT.NCM)NCM=ITL1
      NL=NL+1
      IX1=IX-IHORZ*ITL1*.5*CO*(1-IC)
      IYP=IY1-IHORZ*ITL1*.5*SI*(1-IC)
      CALL NOTATE(IX1,IYP,ITL1,IP)
      IX=IX+IVERT*1.1*SI
      IY1=IY1-IVERT*1.1*CO
      ITL1=0
   70 CONTINUE
      XH=.5*IHORZ*NCM+.5*IHORZ
      YH=1.0*IVERT
      XHH=.5*IHORZ*NCM*IC
      IXI=IXI+CO*XHH
      IYI=IYI+SI*XHH
      IPX(1)=IXI-XH*CO-YH*SI
      IPY(1)=IYI-XH*SI+YH*CO
      IPX(2)=IXI+XH*CO-YH*SI
      IPY(2)=IYI+XH*SI+YH*CO
      YH=(1.1*IVERT*(NL-1)+.3*IVERT)
      IPY(4)=IYI-XH*SI-YH*CO
      IPX(4)=IXI-XH*CO+YH*SI
      IPX(3)=IXI+XH*CO+YH*SI
      IPY(3)=IYI+XH*SI-YH*CO
      END
CPGRIDX
      SUBROUTINE PGRIDX(ITX,ITY,NTIT,NXU,NYU,IDX,ISKIP)
      DIMENSION ITX(4,50),ITY(4,50),IPP(100),ITN(100),IDN(10)
      IPEND=3960
      DEL=2400./NYU
      NMAX=NYU+1
      DO 1000 N=1,NMAX,ISKIP
      IPY=300.+DEL*(NMAX-N)
      K=0
      DO 101 L=1,NTIT
      J=4
      DO 100 I=1,4
      IX1=ITX(J,L)
      IX2=ITX(I,L)
      IY1=ITY(J,L)
      IY2=ITY(I,L)
      IMINY=MINO(IY1,IY2)
      IF(IPY.LE.IMINY) GO TO 100
      IMAXY=MAXO(IY1,IY2)
      IF(IPY.GT.IMAXY)GO TO 100
      IF(IX1.EQ.IX2)GO TO 50
      S=(IY2-IY1)/FLOAT(IX2-IX1)
      B=FLOAT(IY1)-S*IX1
      IX1=IFIX((FLOAT(IPY)-B)/S)
   50 LL=L
      IF(IX1.GT.IPEND)GO TO 100
      IF(K.EQ.0)GO TO 95
      DO 90 M1=1,K
      IF(IX1.GT.IPP(M1))GO TO 90
      IPS1=IPP(M1)
      IPP(M1)=IX1
      IX1=IPS1
      IPS1=ITN(M1)
      ITN(M1)=LL
      LL=IPS1
   90 CONTINUE
   95 K=K+1
      ITN(K)=LL
      IPP(K)=IX1
  100 J=I
  101 CONTINUE
      NC=0
      K=K+1
      IPP(K)=IPEND
      ITN(K)=0
      IPO=600
      CALL MOVABS(IPO,IPY)
      DO 200 I=1,K
      L=ITN(I)
      IPX=IPP(I)
      IF(NC.EQ.0)GO TO 160
      DO 120 J=1,NC
      IF(IDN(J).EQ.L) GO TO 130
  120 CONTINUE
      NC=NC+1
      IDN(NC)=L
      GO TO 140
  130 IDN(J)=IDN(NC)
      NC=NC-1
  140 CALL MOVABS(IPX,IPY)
      IPO=IPX
      GO TO 200
  160 IF(IPX.LT.IPO) GO TO 200
  165 IF(IPX.LT.(IPO+IDX)) GO TO 180
      IPO=IPO+IDX
      CALL DRWABS(IPO,IPY)
      GO TO 165
  180 CALL DRWABS(IPX,IPY)
      IPO=IPX
      NC=NC+1
      IDN(NC)=L
  200 CONTINUE
 1000 CONTINUE
      END
CPGRIDY
      SUBROUTINE PGRIDY(ITX,ITY,NTIT,NXU,NYU,IDX,ISKIP)
      DIMENSION ITX(4,50),ITY(4,50),IPP(100),ITN(100),IDN(10)
      IPEND=2700
      DEL=3360./NXU
      NMAX=NXU+1
      DO 1000 N=1,NMAX,ISKIP
      IPX=600.+DEL*(NMAX-N)
      K=0
      DO 101 L=1,NTIT
      J=4
      DO 100 I=1,4
      IX1=ITX(J,L)
      IX2=ITX(I,L)
      IY1=ITY(J,L)
      IY2=ITY(I,L)
      IMINX=MINO(IX1,IX2)
      IF(IPX.LE.IMINX) GO TO 100
      IMAXX=MAXO(IX1,IX2)
      IF(IPX.GT.IMAXX)GO TO 100
      IF(IY1.EQ.IY2)GO TO 50
      S=(IX2-IX1)/FLOAT(IY2-IY1)
      B=FLOAT(IX1)-S*IY1
      IY1=IFIX((FLOAT(IPX)-B)/S)
   50 LL=L
      IF(IY1.GT.IPEND)GO TO 100
      IF(K.EQ.0)GO TO 95
      DO 90 M1=1,K
      IF(IY1.GT.IPP(M1))GO TO 90
      IPS1=IPP(M1)
      IPP(M1)=IY1
      IY1=IPS1
      IPS1=ITN(M1)
      ITN(M1)=LL
      LL=IPS1
   90 CONTINUE
   95 K=K+1
      ITN(K)=LL
      IPP(K)=IY1
  100 J=I
  101 CONTINUE
      NC=0
      K=K+1
      IPP(K)=IPEND
      ITN(K)=0
      IPO=300
      CALL MCVABS(IPX,IPO)
      DO 200 I=1,K
      L=ITN(I)
      IPY=IPP(I)
      IF(NC.EQ.0)GO TO 160
      DO 120 J=1,NC
      IF(IDN(J).EQ.L) GO TO 130
  120 CONTINUE
      NC=NC+1
      IDN(NC)=L
      GO TO 140
  130 IDN(J)=IDN(NC)
      NC=NC-1
  140 CALL MCVABS(IPX,IPY)
      IPO=IPY
      GO TC 200
  160 IF(IPY.LT.IPO) GC TC 200
  165 IF(IPY.LT.(IPO+IDX)) GO TO 180
      IPO=IPO+IDX
      CALL DRWAES(IPX,IPO)
      GO TO 165
  180 CALL DRWAES(IPX,IPY)
      IPO=IPY
      NC=NC+1
      IDN(NC)=L
  200 CONTINUE
 1000 CONTINUE
      END
CINTITE
      SUBROUTINE INTITE(XO,YO)
C***** SPECIAL INTERACTIVE TITLE ROUTINE
      DIMENSION IQUICK(30),MSG1(11),MSG2(5),MSG3(5),MSG4(19),MSG5(11)
      DIMENSION MSG6(7)
      DIMENSION IPPX(4),IPPY(4),VTEM(5)
      COMMON/ITITLE/IT(50),JT(50),KT(50),LT(50),MT(50),ST(50),
     1 XT(50),YT(50),XU(50),YU(50),XV(50),YV(50),ITC(8,50),NTITE
      COMMON/TEKGPPR/LDEL,LCNT,MAXSR,LTV(17),EN(2),DEL(2),BEG(2),RDX2,
     1RDY2,NLINE,NDRAW(50)
      IXTOS(X)=((X-BEG(1))/DEL(1)+600)
      IYTOS(Y)=((Y-BEG(2))/DEL(2)+300)
      XTOSX(X)=(X-600.)*DEL(1)+BEG(1)
      YTOSY(Y)=(Y-300.)*DEL(2)+BEG(2)
      DATA IQUICK/7,0,9,4,0,0,0,2,0,0,
     1            0,1,2,6,0,8,5,0,3,0,
     2            0,2,0,0,0,0,0,0,0,0/
C**** ANGLE POINT
      DATA MSG1/65,78,71,76,69,32,80,79,73,78,84/
C**** SIZE
      DATA MSG2/83,73,90,69,32/
C**** TITLE
      DATA MSG3/84,73,84,76,69/
C**** ILLEGAL
      DATA MSG6/73,76,76,69,71,65,76/
C**** ENTER IT,ANGLE,SIZE
      DATA MSG4/69,78,84,69,82,32,73,44,74,44,75,44,65,78,71,
     1 44,83,73,90/
C**** ENTER TITLE
      DATA MSG5/69,78,84,69,82,32,84,73,84,76,69/
      LCNT=LCNT-50
      CALL PLCHAR(25,39)
      CALL ANMODE
      CALL NOTATE(0,LCNT,5,MSG3)
      IF(NTITE.EC.0)GO TO 140
      GC TC 20
   10 CALL PLCHAR(25,39)
      CALL VCURSR(ICHAR,XO,YO)
C**** IF NC TITLES THEN ASSUME TC ADD CNE
      IF(NTITE.EQ.0)GO TO 140
      IF(ICHAR.LT.64.OR.ICHAR.GE.95) GO TO 210
      ICHAR=ICHAR-64
      ICHECK=IQUICK(ICHAR)
      IF(ICHECK.EC.0) GO TO 210
      GO TO (20,50,70,80,220,140,110,180,300)ICHECK
C**** 7=A ANGLE
C**** 1=C POSITION
C**** 4=D DELETE TITLE
C**** 5=E EXIT FROM INTERACTIVE TITLE
C**** 2=M MOVE TITLE POSITION
C**** 6=N NEW TITLE INSERT
C**** 3=S CHANGE SIZE OF LETTERS
C****
C**** POSITION ON TITLE CLOSEST
   20 DSAVE=1.E40
      DO 40 K=1,NTITE
      XXX=XT(K)
      YYY=YT(K)
      IF(IT(K).EQ.0)GC TO 30
      XXX=XTOSX(XXX)
      YYY=YTOSY(YYY)
   30 XDX=XXX-XO
      YDY=YYY-YO
      DIST=XDX*XDX*RDX2+YDY*YDY*RDY2
      IF(DIST.GT.DSAVE)GO TO 40
      NTF=K
      XXP=XXX
      YYP=YYY
      DSAVE=DIST
   40 CONTINUE
      CALL POINTA(XXP,YYP)
      GC TC 10
C****** MOVE TITLE AND CORRECT ANGLE
   50 IF(NTF.EQ.0)GO TO 210
      IF(IT(NTF).EC.0)GO TO 60
      XO=IXTOS(XO)
      YO=IYTOS(YO)
   60 XT(NTF)=XC
      YT(NTF)=YO
      CALL POINTA(XC,YO)
      IF(ICHAR.NE.8)GO TO 61
      XU(NTF)=XV(NTF)=0.
      YU(NTF)=YV(NTF)=0.
      GO TC 180
   61 IF(ICHAR.NE.22)GO TC 62
      XU(NTF)=XV(NTF)=YU(NTF)=0.
      YV(NTF)=1.
      GO TC 180
   62 CALL VCURSR(ICA,XO,YO)
      XU(NTF)=XO
      YU(NTF)=YO
  120 CALL POINTA(XO,YO)
      CALL VCURSR(ICH,XB,YB)
      CALL POINTA(XB,YB)
      XV(NTF)=XB
      YV(NTF)=YB
C**** PLOT NEW TITLE
      GO TC 180
C****
C**** CHANGE THE SIZE OF THE TITLE
   70 IF(NTF.EQ.0) GO TO 210
      LCNT=LCNT-50
      CALL NOTATE(0,LCNT,5,MSG2)
      CALL ANMODE
      CALL GETIN(1,ST(NTF))
      GO TC 10
C****
C**** DELETE TITLE
   80 IF(NTF.EQ.0)GO TC 20
      IF(NTF.EQ.NTITE)GO TO 100
      IT(NTF)=IT(NTITE)
      JT(NTF)=JT(NTITE)
      KT(NTF)=KT(NTITE)
      ST(NTF)=ST(NTITE)
      XT(NTF)=XT(NTITE)
      YT(NTF)=YT(NTITE)
      XU(NTF)=XU(NTITE)
      YU(NTF)=YU(NTITE)
      XV(NTF)=XV(NTITE)
      YV(NTF)=YV(NTITE)
      DO 90 I=1,8
   90 ITC(I,NTF)=ITC(I,NTITE)
  100 NTITE=NTITE-1
      NTF=0
      GO TC 10
C****
C**** ADD ARRCW TC TITLE CCDE
C****
  110 NTITE=NTITE+1
      NTF=NTITE
      IT(NTF)=0
      JT(NTF)=0
      KT(NTF)=1
      DO 150 I=1,8
  150 ITC(I,NTITE)=10H
      ITC(1,NTITE)=10HARROW
      GC TC 60
C**** ADD NEW TITLE
  140 LCNT=LCNT-50
      CALL NOTATE(0,LCNT,10,MSG4)
      CALL ANMODE
      CALL GETIN(2,VTEM)
      LCNT=LCNT-50
      CALL NOTATE(0,LCNT,11,MSG5)
      NTITE=NTITE+1
      NTF=NTITE
      IT(NTF)=VTEM(1)
      JT(NTF)=VTEM(2)
      KT(NTF)=0
      ST(NTF)=.15
      CALL ANMCDE
      READ (5,170)(ITC(I,NTITE),I=1,8)
  170 FORMAT(8A10)
      GO TO 50
C****
C****  PRINT TITLE AND ASK AGAIN
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C****
  180 IF(NTF.EQ.0)GO TO 210
      I=NTF
      IF(KT(I).EQ.1)GO TO 200
      CALL SWCHAR(1)
      IX=XT(I)
      IY=YT(I)
      IF(IT(I).EQ.1)GO TO 190
      IX=IXTOS(XT(I))
      IY=IYTOS(YT(I))
  190 IF(ST(I).LE.0.)ST(I)=.10
      ICH=KIN(ST(I)*.873)
      ICV=ICH*1.6
      IC=JT(I)
      CALL PLCHAR(ICH,ICV)
      DANGX=(XV(I)-XU(I))*SQRT(RDX2)
      DANGY=(YV(I)-YU(I))*SQRT(RDY2)
      ANG=0.
      IF(DANGY.EQ.0..AND.DANGX.EQ.0.) GO TO 195
      ANG=ATAN2(DANGY,DANGX)*57.2957795
  195 CALL PTITE(IX,IY,8,ITC(1,I),IC,70,ANG,IPPX,IPPY)
      CALL LINROT(0.)
      CALL SWCHAR(0)
      GO TO 10
  200 IA1=IXTOS(XU(I))
      IA2=IYTOS(YU(I))
      IB1=IXTOS(XV(I))
      IB2=IYTOS(YV(I))
      CALL MOVEA(XT(I),YT(I))
      CALL DARROW(IA1,IA2,IB1,IB2)
      GO TO 10
C****
C**** COPY HEADING
C****
  300 IF(NTF.EQ.0)GO TO 210
      NTO=NTF
      NTITE=NTITE+1
      NTF=NTITE
      IT(NTF)=IT(NTO)
      JT(NTF)=JT(NTO)
      KT(NTF)=KT(NTO)
      ST(NTF)=ST(NTO)
      DO 310 I=1,8
  310 ITC(I,NTF)=ITC(I,NTO)
      GO TO 50
  210 LCNT=LCNT-50
      CALL NOTATE(0,LCNT,7,MSG6)
      GO TO 10
C****
C**** END OF INTERACTIVE TEST
  220 RETURN
      END
CDARROW
      SUBROUTINE DARROW(IX1,IY1,IX2,IY2)
      CALL DRWABS(IX1,IY1)
      ANG=0.
      IF(IY2.EQ.IY1.AND.IX2.EQ.IX1)GO TO 10
      ANG=ATAN2(FLOAT(IY2-IY1),FLOAT(IX2-IX1))
   10 I2=IY2-80.*SIN(ANG-.2)
      I1=IX2-80.*COS(ANG-.2)
      I4=IY2-80.*SIN(ANG+.2)
      I3=IX2-80.*COS(ANG+.2)
      IX=.5*(I1+I3)
      IY=.5*(I2+I4)
      CALL DRWABS(IX,IY)
      CALL DRWABS(I1,I2)
      CALL DRWABS(IX2,IY2)
      CALL DRWABS(I3,I4)
      CALL DRWABS(I1,I2)
      RETURN
      END
CGETIN
                                                                  GETI0001
      SUBROUTINE GETIN(NIN,Y)                                             GETI0002
C                                                                         GETI0003
C         SIMULATED MISSION ENGINE TEST CODE                              GETI0004
C           MICHAEL CADDY  3/19/78                                        GETI0005
      DIMENSION Y(1),IC(80)                                               GETI0006
C        FREE FORM INPUT CODE                                             GETI0007
      NW=0                                                                GETI0008
   10 J=0                                                                 GETI0009
      READ 20,IC                                                          GETI0010
C        CHECK FOR END OF FILE                                            GETI0011
      IF(EOF(5).EQ.0)GO TO 30                                             GETI0012
      NIN=NW                                                              GETI0013
      RETURN                                                              GETI0014
   20 FORMAT(80R1)                                                        GETI0015
   30 JC=0                                                                GETI0016
      JD=0                                                                GETI0017
      JS=1                                                                GETI0018
      NC=0                                                                GETI0019
      X=0.                                                                GETI0020
   40 J=J+1                                                               GETI0021
C        ONLY ONE CARD PER INPUT READ                                     GETI0022
C         MODIFIED TO READ MORE THAN ONE CARD 4/26/78 MJC
      IF(J.GT.80)  GO TO 10                                               GETI0023
      I=IC(J)                                                             GETI0024
C        CHECK FOR VALID NUMERIC FIELD                                    GETI0025
      IF(I.GT.32B.AND.I.LT.45B) GO TO 110                                 GETI0026
C        IGNORE LEAD + SIGN                                               GETI0027
      IF(I.EQ.45B) GO TO 40                                               GETI0028
C        SET FLAG FOR NEGATIVE VALUE                                      GETI0029
      IF(I.NE.46B) GO TO 50                                               GETI0030
      JS=-1                                                               GETI0031
      GO TO 40                                                            GETI0032
C        CHECK FOR DECIMAL                                                GETI0033
   50 IF(I.NE.57B) GO TO 60                                               GETI0034
      IF(JC.EQ.-1) GO TO 120                                              GETI0035
C        IF THIS IS SECOND DECIMAL BLOW OFF TO ERROR CODE                 GETI0036
      JC=-1                                                               GETI0037
      GO TO 40                                                            GETI0038
C        CHARACTER IS BLANK TREAT AS COMMA IF NOT LEADING                 GETI0039
   60 IF(I.EQ.55B)GO TO 80                                                GETI0040
      IF(I.EQ.56B)GO TO 70                                                GETI0041
      GO TO 120                                                           GETI0042
   70 IF(NC.GT.0)GO TO 90                                                 GETI0043
      NW=NW+1                                                             GETI0044
      IF(NW.GT.NIN) RETURN                                                GETI0045
      GO TO 40                                                            GETI0046
C        TWO COMMAS ..IGNORE THIS DATA FIELD AND GO ON TO NEXT            GETI0047
   80 IF(NC.EQ.0) GO TO 40                                                GETI0048
C        SHIFT DECIMAL TO NUMBER                                          GETI0049
   90 X=JS*X*10.**JD                                                      GETI0050
      NW=NW+1                                                             GETI0051
      Y(NW)=X                                                           GETI0052
      IF(NW.GE.NIN) RETURN                                              GETI0053
      GO TO 30                                                          GETI0054
  110 JD=JD+JC                                                          GETI0055
      NC=NC+1                                                           GETI0056
C         ADD DIGIT TO NUMBER ,,CAREFULLY                               GETI0057
      X=X*10+(I-33B)                                                    GETI0058
      GO TO 40                                                          GETI0059
C         ERROR CODE                                                    GETI0060
  120 DO 130 K=1,80                                                     GETI0061
  130 IC(K)=55B                                                         GETI0062
      IC(J)=47B                                                         GETI0063
      PRINT 140 ,IC                                                     GETI0064
  140 FORMAT(2X,80R1)                                                   GETI0065
      PRINT 150                                                         GETI0066
  150 FORMAT(* EAD FIELD, RE-ENTER DATA*)                               GETI0067
      GO TO 10                                                          GETI0068
      END                                                               GETI0069
      SUBROUTINE AXIS(IX,IY,IEX,IEY,ID,IC,AB,DT,EX,IJ,JZZ,NTB,LINE,SIZ)
C
C IX -ORIGIN X-COORDINATE  (SCREEN  UNITS)
C IY  - ORIGIN Y-COORDINATE (SCREEN  UNITS)
C IE - AXIS LENGTH (SCREEN UNITS)
C  ID - NO. OF  DIVISIONS  ON AXIS
C  IC -- 0=HORIZONTAL  LINE    ;   1=VERTICAL LINE
C AB--AXIS BEGINNING(REAL UNITS)
C DT--CHANGE IN SCALE BETWEEN TIC MARKS (REAL UNITS)
C NTB--NO. OF MINOR TICKS
C LINE-GRID LINE CODE(DRAW EVERY N GRIDS)
C SIZ-CHARACTER SIZE
       DIMENSION NODEC(4)
      DIMENSION JA(10)
      JZ=JZZ
      XB=IX
      YB=IY
      CALL SWCHAR(1)
      ICH=KIN(SIZ*.873)
      IE=IEX
      IF(IC.EQ.1) IE=IEY
      ICV=ICH*1.6
      CALL PLCHAR(ICH,ICV)
      CALL CSIZE(JH,JV)
      DATA XY/292./
      DO 1 I=1,4
    1 NODEC(I)=0
      Y=0.
C  DETERMINING NO. OF DECIMAL PTS IN LABELS ON AXIS
      CALL ANNOT(IX,Y,Z,JA,IJ,NODEC(1),NO,NODE)
      LL=NO
      CALL ANNOT(IY,Y,Z,JA,IJ,NODEC(2),NO,NODE)
      IF(NO.GT.LL)LL=NO
      CALL ANNOT(AB,Y,Z,JA,IJ,NODEC(3),NO,NODE)
      IF(NO.GT.LL)LL=NO
      CALL ANNOT(DT,Y,Z,JA,IJ,NODEC(4),NO,NODE)
      IF(NO.GT.LL)LL=NO
      NODE=MAX0(NODEC(1),NODEC(2),NODEC(3),NODEC(4))
      EX=0.
C  DETERMINING EXPONENT
      DA=ABS(DT)
      IF(DA) 3,7,3
    3 IF(DA-99.) 6,4,4
    4 DA=DA/10.
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      EX=EX+1.
      GO TO 3
    5 DA=DA*10.
      EX=EX-1.
    6 IF(DA-.01)  5,7,7
    7 CONTINUE
      XV=AB*10.**(-EX)
      DA=DT*10.**(-EX)
      AA=IC*2-1
      CH=1-IC
      SH=IC
      NT=ID+1
      JT=JV
      IF(IC.EQ.0) JT=(LL+2)*JH
      NA=IE/ID
C**** JZ= HOW MANY TO SKIP LABELING
   60 IF(JT.LT.JZ*NA) GO TO 70
      JZ=2*JZ
      GO TO 60
   70 NX=XB+CH*IE
      NY=YB+SH*IE
      CALL MOVABS(NX,NY)
      IDX=-XY*AA*SH*.07
      IDY=XY*AA*CH*.07
C**** NUMBER OF MINOR TICKS
      NTBB=NTB+1
C**** TOTAL NUMBER OF TICKS
      IA=ID*NTBB
      DEL=FLOAT(IE)/FLOAT(IA)
C  LOOP FOR AXIS LINE & TICS
      DELM=FLOAT(IE)/ID
      DO 30 I=1,NT
      NX=XB+DELM*CH*(NT-I)
      NY=YB+DELM*SH*(NT-I)
      KL=2
      DO 30 J=1,NTBB
      CALL DRWABS(NX,NY)
      CALL DRWABS(NX+IDX*KL,NY+IDY*KL)
      CALL DRWABS(NX,NY)
      IF(I.EQ.NT) GO TO 34
      IA=IA-1
      NX=XB+DEL*CH*IA
      NY=YB+DEL*SH*IA
   30 KL=1
   34 X=IX+IDX
      Y=IY+IDY
      IF(IC.EQ.0) GO TO 61
      X=X-LL*JH
      GO TO 62
   61 X=X-JH
      Y=Y-JV
   62 XV=AB*10.**(-EX)
      YN=1.
      XN=NX
      CALL ANNOT(XV,X,YN,JA,IJ,J,NO,NCDE)
      NN=IFIX(X)-JH
      JJ=IFIX(Y)
      IF(IC.EQ.0) JJ=JJ-IFIX(.1*JV-IDY)
      NNX=NN-JH*(NO/2)-JH/2
      IF(IC.EQ.1) NNX=IX+IDX-6.0*JH
      IF(IC.EQ.1)JJ=JJ-3*JV/8
      CALL NOTATE(NNX,JJ,5,JA)
      IN=0
      NTT=NT-1
      DEL=FLOAT(IE)/ID
C  LABEL AXIS
      DO 63 I=1,NTT
      IN=IN+1
      XV=XV+DA
      XN=XN+CH
      YN=YN+SH
      IF(IN.NE.JZ) GO TO 63
      IN=0
      YN=1.
      CALL ANNOT(XV,XN,YN,JA,IJ,J,NC,NODE)
      IF(IC.EQ.0)GO TO 50
      JJ=JJ+(DEL*JZ)
      GO TO 51
   50 NN=NN+(DEL*JZ)
      NNX=NN-JH*(NC/2)-JH/2
   51 CALL NOTATE(NNX,JJ,5,JA)
   63 CONTINUE
      RETURN
      END
      SUBROUTINE ANNOT(X,Y,Z,JA,IJ,N,NO,NODE)
C SUBROUTINE TO DETERMINE CHARACTERS FOR LABELLING AXIS
C  OUTPUT GOES IN JA(1-10)   (LEFT JUSTIFIED)
      DIMENSION JA(10)
      XX=X
      I=0
      DO 1 J=1,10
    1 JA(J)=32
      ENCODE(10,5,I) XX
    5 FORMAT(F10.2)
      CALL KAM2AS(10,I,JA)
      IF(JA(1).NE.32) GO TO 50
      DO 10 I=1,9
      IF(JA(I).NE.32) GO TO 40
   10 CONTINUE
      GO TO 50
   40 DO 45 J=I,10
   45 JA(J-I+1)=JA(J)
      L=12-I
      DO 46 K=L,10
   46 JA(K)=32
   50 CONTINUE
      IF(Z.GT..5) GO TO 30
      N=0
      DO 110 I=1,10
      IF(JA(I).NE.46) GO TO 110
      IF(JA(I+2).NE.32.AND.JA(I+2).NE.48) GO TO 20
      IF(JA(I+1).NE.32.AND.JA(I+1).NE.48) GO TO 15
  110 CONTINUE
      GO TO 25
   15 N=1
      GO TO 25
   20 N=2
   25 CONTINUE
      RETURN
   30 CONTINUE
      IF(NODE.GT.0) GOTO2
      DO 101 I=1,10
     IF(JA(I).NE.46) GOTO101
     J=I-1
     DO 201 K=I,10
```

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 201 JA(K)=32
     GO TC 100
 101 CCKTINUE
     GCTC100
   2 DO 12 I=1,10
     IF(JA(I).NE.46) GCTC12
      J=I+NCDE+1
     DO 22 K=J,10
  22 JA(K)=32
     J=J-1
     GO TO 100
  12 CONTINUE
 100 CONTINUE
     NO=5-J
     IF(JA(1).EC.46.AND.J.NE.1) JA(1)=32
     IF(J.GT.4)RETURN
     DO 461 L=1,J
     JA(6-L)=JA(J+1-L)
 461 JA(J-L+1)=32
     RETURN
     END
CAXSCAL
     SUBROUTINE AXSCALE(X,AXL,N,XSTART,XINC,ISIZE)
C ***  X-ARRY  OF DATA    AXL-AXIS LENGTH INCHES
C *** N- NO. OF POINTS IN ARRAY $ XINC-INCREMENT PER INCH
C *** XSTART FIRST NO. ON AXIS
C *** ISIZE=0 USE 10 TO THE INCH SCALING  ,NOT =0 USE 20
     DIMENSION X(1),L(5)
     XMAX=XMIN=X(1) $ L(1)=1 $L(2)=2 $ L(3)=5  $L(4)=10 $ L(5)=20
     IF(AXL.LE.0.)AXL=1.
     IF(ISIZE.NE.0) L(3)=4
     IF(N.LE.1) GC TO 70
     DO 60 I=2,N
     XCHECK=X(I)
     IF(XCHECK.GT.XMAX)XMAX=XCHECK
     IF(XCHECK.LT.XMIN)XMIN=XCHECK
60   CONTINUE
70   F=(XMAX-XMIN)/AXL
     IF(F.EC.0.) F=XMAX/AXL
     J=-10
     DO 100 I=1,20
     K=10.**J*F
     IF(K.NE.0) GO TC 110
100  J=J+1
110  DO 120 I=2,4
     IF(L(I).GT.K)  GC TO 130
120  CONTINUE
 130 XINC=L(I-1)/10.**J
     K=XMIN/XINC
     IF((XMIN/XINC).LT.-.06) K=K-1
     XSTART=K*XINC
     XH=(XMAX-XSTART)/XINC
     XL=(XMIN-XSTART)/XINC
     IF(XH.GT.(AXL+.06).CR.XL.LT.-.06) 140,150
 140 I=I+1
     GO TC 130
 150 CONTINUE
     RETURN
     END
```

What is claimed is:

1. A process for generating a camera-ready hardcopy of a graphical plot of certain physical quantities or existing plots using a general purpose digital computer, a graphics display terminal having an alpha-numeric keyboard and a cursor control, and an associated printer, comprising in sequence the steps of:

storing in the computer an interactive graphics code and coordinate data in tabular form associated with the physical quantities or existing plots, said code being identified by interactive command repetition and feedback for deletion, addition and transition of lines, points and labels while processing the stored coordinate data;

plotting on the screen the stored coordinate data in a format according to said code;

generating on the screen lines between the plotted coordinate data according to said code;

revising the coordinate data and the lines plotted on the screen by manipulating the cursor and keyboard in accordance with said code, said revising step further including

adding coordinate data to create new lines,

deleting coordinate data to remove lines, and

moving coordinate data to change the position of existing lines; and

printing a hardcopy of the revised plot on the printer.

2. A process as recited in claim 1, wherein, immediately following said step of revising the coordinate data, the following step is included:

labeling appropriate areas of the revised plot on the screen by manipulating the cursor and keying the computer in accordance with the interactive code.

3. A process as recited in claim 2, wherein immediately following said step of labeling, the following step is included:

shading appropriate areas of the revised plot on the screen by manipulating the cursor and keying the computer in accordance with the interactive code.

4. A process as recited in claim 3, wherein immediately following said step of shading, the following step is included:

applying appropriate reference symbols and characters to the revised plot on the screen by manipulating the cursor and keying the computer in accordance with the interactive code.

5. A process as recited in claim 1, wherein said step of plotting comprises:

establishing appropriately scaled and titled coordinate axes on the screen; and

establishing appropriate grid lines substantially horizontally and vertically on the screen.

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